Monograph of *Moranopteris* (Polypodiaceae)

by

Regina Y. Hirai and Jefferson Prado

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by

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American Fern Society

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Contents

Abstract . . . 3
Introduction . . . 3
Material and Methods . . . 4
Results and Discussions . . . 4
Ecology . . . 4
Geography . . . 6
Morphology . . . 6
Rhizome Scales . . . 7
Laminar Dissection . . . 7
Segments . . . 12
Hydathodes . . . 13
Veins . . . 13
Setae . . . 13
Hairs . . . 13
Phylogenetic Studies . . . 14
Taxonomic Treatment . . . 14
Moranopteris . . . 15
Key to the Species . . . 15
Species Treatments . . . 17
1. *Moranopteris achilleifolia* . . . 17
2. *Moranopteris aphelolepis* . . . 21
3. *Moranopteris basiattenuata* . . . 24
4. *Moranopteris blepharidea* . . . 27
5. *Moranopteris caucana* . . . 30
6. *Moranopteris cookii* . . . 33
7. *Moranopteris gradata* . . . 36
8. *Moranopteris grisebachii* . . . 39
9. *Moranopteris hyalina* . . . 41
10. *Moranopteris killipii* . . . 44
11. *Moranopteris knowltoniorum* . . . 46
12. *Moranopteris liesneri* . . . 48
13. *Moranopteris longisetosa* . . . 50
14. *Moranopteris microlepis* . . . 53
15. *Moranopteris nana* . . . 56
16. *Moranopteris nimbata* . . . 61
17. *Moranopteris perpusilla* . . . 63
18. *Moranopteris plicata* . . . 65
19. *Moranopteris rupicola* . . . 68
20. *Moranopteris serricula* . . . 70
21. *Moranopteris setosa* . . . 72
22. *Moranopteris sherringii* . . . 74
23. *Moranopteris simplex* . . . 76
24. *Moranopteris taenifolia* . . . 78
25. *Moranopteris trichomanoides* . . . 84
26. *Moranopteris truncicola* . . . 87
27. *Moranopteris williamsii* . . . 91
28. *Moranopteris zurquina* . . . 91
29. *Moranopteris* x*bradei* . . . 93
Names of Uncertain Application . . . 95
Acknowledgements . . . 96
Literature Cited . . . 96
Appendix 1: List of Taxa . . . 98
Appendix 2: List of Names . . . 99
Appendix 3: List of Exsiccatae . . . 101

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Abstract.—Twenty-eight species and one hybrid are here recognized for *Moranopteris*, a grammitid genus from the Neotropics. An identification key is given, and for each species a description is provided, as well as full synonymy, discussion, illustration, distribution map, and a list of specimens examined. The Andean and Central American regions are primary centers of diversity of *Moranopteris*, with 14 and 12 species, respectively. The mountains of Coastal Brazil are an important secondary center of endemism and diversity for the genus.

Introduction

Moranopteris is a genus of Neotropical grammitid ferns published by Hirai *et al.* (2011). It comprises 28 species and one hybrid. Previously, this group was included within *Micropolypodium* Hayata, but molecular analysis has shown that *Micropolypodium s. str.* is a small genus restricted to eastern Asia (Hirai *et al.* 2011).

The majority of species now included in *Moranopteris* have been recognized in other genera, for example: in *Polypodium* by Maxon (1916), *Xiphopteris* by Copeland (1952), *Grammitis* by Morton (1967), and *Micropolypodium s.l.* by Smith (1992). A few species of *Moranopteris* were placed in *Ctenopteris* (e.g., Copeland 1952) and *Terpsichore* (Smith 1993).

In general, floristic accounts have treated species of *Moranopteris* (as *Micropolypodium*) for different geographic regions. For Mexican and Central American species, these treatments include: Chiapas, Mexico (Smith 1981); Guatemala (Stolze 1981); Oaxaca, Mexico (Mickel and Beitel 1988); Costa Rica, Panama, and Chocó (Lellinger 1989); Mesoamerica (Smith 1995); Mexico (Mickel and Smith 2004); and Nicaragua (Gómez and Arbeláez 2009). For the Greater Antilles, treatments include: Jamaica (Proctor 1985); Puerto Rico and the Virgin Islands (Proctor 1989); and the Lesser Antilles: Proctor (1977). For the Andes, accounts are for Ecuador (Morton 1967) and Peru (Tryon and Stolze 1993). Elsewhere in South America, regional treatments are available for species of Venezuelan Guayana (Smith 1990, Bishop and Smith 1995), French Guiana (Cremers 1997), and southeastern Brazil (Labiak and Prado 2005).

Smith (1992) published a review of the genus *Micropolypodium s.l.*, comprising about 30 species. For the Neotropical region he listed 22 species and two species in eastern Asia. Parris (2009) mentioned that *Micropolypodium s.l.* comprised 25 species.

Micropolypodium s.l., according to Smith (1992), has radially symmetrical, erect rhizomes, often golden brown, nonclathrate rhizome scales, linear leaves usually less than 10 mm wide and often less than 6 mm wide, segments (pinnae) with a single unbranched vein or with only an acroscopic branch, segments often gibbous and with prominent adaxial hydathodes, long dark red-brown, unbranched setae, and unisoriate segments.

Smith (1993) recognized five groups in *Terpsichore s.l.* One of them, the *T. achilleifolia* group with only three species, is distinct from the other groups by having orangish to golden scales on the rhizomes, leaves with determinate growth, hydathodes on the adaxial laminar surfaces, and dark red-brown unbranched setae on laminar tissue.

Labiak and Matos (2007) described the hybrid *Micropolypodium* x*bradei* Labiak & F. B. Matos from Rio de Janeiro (Brazil). Its putative parents are *M. setosum* (Kaulf.) A. R. Sm. and *Terpsichore achilleifolia* (Kaulf.) A. R. Sm. Using both morphological evidence and preliminary molecular studies (Ranker *et al.* 2004), Labiak and Matos concluded that *T. achilleifolia* and *T. gradata* (Baker) A. R. Sm. should be transferred to *Micropolypodium.* The phylogenetic analysis conducted by Hirai *et al.* (2011) further confirmed that the *Terpsichore achilleifolia* group of Smith (1993, including *T. achilleifolia*, *T. gradata*, and *T. longisetosa* (Hook.) A. R. Sm., belonged to *Moranopteris.*

In brief, *Moranopteris* has all the morphological features of *Micropolypodium* as described by Smith (1992), but also includes a few species with pinnate laminae and veins with more than one sorus per segment or pinna. More details about the morphological characters are presented under the results and discussion in the present paper.

The purpose of the present study is to review the species of *Moranopteris* and provide an up-to-date taxonomic treatment for the genus.

Material and Methods

Herbarium specimens were borrowed from 39 herbaria worldwide (see Acknowledgments).

The recognition of species in *Moranopteris* was based on morphological characters: rhizome scales, setae, laminar dissection, segments, hydathodes, veins, and hairs (see details under morphology).

For Selected Specimens Examined, in general only one specimen was cited per state, province, or department, except when there were only few specimens for the species or when the specimens were used to draw the figures. Distribution maps (e.g., Fig. 1) were based on all specimens studied, and were generated with DIVA-GIS (version 7.1) and ArcView 8.3. Geographic coordinates were estimated for the specimens lacking precise label data.

All elevation data recorded in feet were converted to meters and appear as such the specimen citations. These converted data were also used to prepare elevational ranges for *Moranopteris* (Fig. 2).

Leaf tissue clearings were made of almost all species using an adapted Strittmatter method (1973, in Kraus and Arduin 1997). Leaves were drawn to show venation and hairs. Hairs were measured on plants from herbarium specimens.

Figure 3 shows some aspects of the morphology of *Moranopteris* and it can be used to follow the key.

Results and discussions

Ecology.—In general, *Moranopteris* inhabits wet, tropical cloud forests at high elevations; these preferences are reflected in the geographic distribution of the genus (Fig. 1). Species rarely occur in disturbed forests. The elevational range

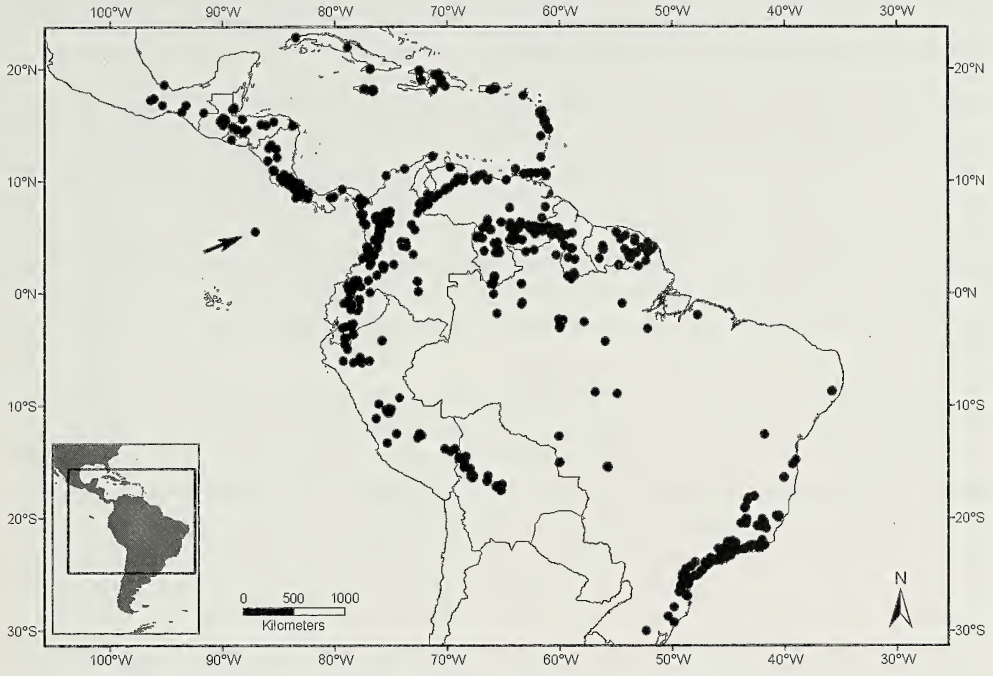

FIG. 1. Distribution of *Moranopteris*. The arrow points to Cocos Island.

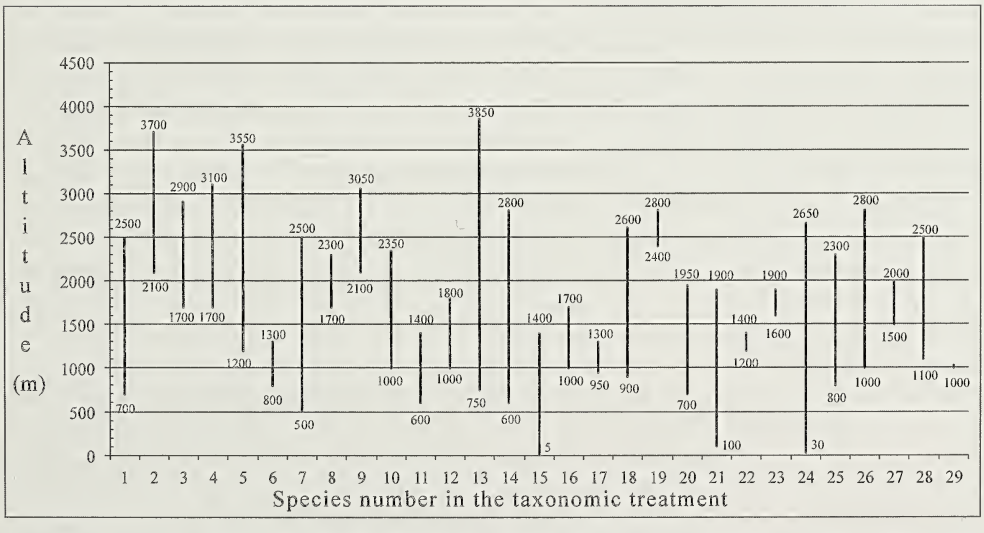

FIG. 2. Elevational ranges (in meters) of *Moranopteris* species. The numbers along the horizontal axis correspond to the species number assigned in the taxonomic treatment.

of *Moranopteris* is from almost sea level to 3850 m, with most plants collected above 1000 m (Fig. 2). Only a few species occur at lower elevations (0–300 m): *M. nana*, *M. setosa*, and *M. taenifolia*.

GEOGRAPHY.—The distribution of species of *Moranopteris* is discussed according to the main regional centers, as defined by Tryon (1972). Andean and Central American regions are primary centers of diversity of *Moranopteris* with 14 and 12 species, respectively. Half of the species of *Moranopteris* occur in the Andean region, of which five are endemic (Table 1). Phytogeographically, parts of Venezuela, Colombia, and Brazil belong to the Guianan region (= Guayana Shield). Guianan and Central America regions are secondary centers of diversity for *Moranopteris* [for terminology, see discussion in Steyermark *et al.* 1995, Vol. 1, p. xix].

The coastal mountains of Serra do Mar, covered by the Atlantic Forest, in the southeastern Brazilian region is also another important secondary center of diversity, with three species (*Moranopteris gradata*, *M. setosa*, and *M. perpusilla*) and one hybrid (*M.* x*bradei*); all of these are endemic (Table 1). In the Andean region there are five endemic species (36%), followed by the Guianan region with two endemic species (22%). Central America, the Greater Antilles, and the Lesser Antilles, each contain one endemic species (Tab. 1).

By country, Costa Rica, Venezuela, and Colombia contain the richest *Moranopteris* flora with 11 species each, followed by Ecuador with 10 species (Table 2).

Similar distribution patterns have been reported for other fern genera and for grammitid ferns, e.g., *Lellingeria s.l.*, *Melpomene*, and *Terpsichore s.l.* (Mickel and Smith 2004). For instance, *Ascogrammitis* (Sundue 2010a) is entirely neotropical, like *Moranopteris*. The Andes are the center of diversity for *Ascogrammitis* (Sundue 2010a) and *Lellingeria s. str.* (Labiak *et al.* 2010b). *Ascogrammitis* is most diverse in the Andes, with 15 of the 17 species restricted to this area (Sundue 2010a). *Lellingeria s.str.* comprises about 50 species (Labiak *et al.* 2010b), of which about 30 species occur in the Andes (60% of the total), and approximately 24 species of them are endemic (80% of the total) to the area. Outside of the Andes, *Lellingeria s. str.* includes 11 species in Central America (six endemic), eight species in the West Indies (four endemic), 10 species in the Guayanan/Venezuelan Shield (six endemic), and six species in southeastern Brazil (three endemic) (Labiak *et al.* 2010b).

Moranopteris nimbata, primarily a Caribbean species, was also reported by Farrar (1967) for North Carolina, U.S.A. This is the only record for *Moranopteris* outside of the Neotropics.

MORPHOLOGY (Figs. 3–5).—As stated by Smith *et al.* (1991), genera of grammitid ferns, including *Micropolypodium*, are circumscribed by combinations of characteristics of their hairs, rhizome scales, sori, and hydathodes. This combination of useful characters can be extended also to the species level. The main characters of *Moranopteris*, important for recognition of species, relate to characteristics of rhizome scales, segment shape, hydathodes, venation, and hair types. These characters have been used by different authors, e.g., Maxon

(1916), Copeland (1952), Smith (1992), Ranker *et al.* (2004), Lehnert (2008), Labiak *et al.* (2010a), Sundue (2010a), and Kessler *et al.* (2011).

Ranker *et al.* (2004) and Sundue (2010b) pointed out that some characters such as root insertion, rhizome scale sheen, number of vascular bundles in the petiole, and presence of buds on the rhizome are important synapomorphies for grammitids as a whole. These characters were not employed here because we were unable to observe them for all studied taxa.

Rhizome scales.—These are an important source of characters for recognition of *Moranopteris* species. Rhizome scales are distinctive in some species or may characterize a group of species. It is very important to leave the scales visible in preparation of herbarium specimens, by removing mosses on the rhizomes and rhizome apices.

The most important character of the rhizome scales relates to their margins. Three basic types of margin can be found on the rhizome scales of *Moranopteris*. One has hyaline or red-brown, mostly long setiform projections (e.g., *M. hyalina* and *M. truncicola*, Figs. 17E, 37E, respectively); another type has entire margins (e.g., *M. williamsii*, Fig. 38E), and the last has glanduliform projections (e.g., *M. longisetosa*, Fig. 3I). All three types can vary and show a few, small, lateral projections (e.g., Fig. 3H).

Color of the rhizomes scales in *Moranopteris* varies from golden to castaneous. The cells of rhizome scales are turgid and are sometimes tinged red-brown toward the tip. Mickel and Smith (2004) used the color of the tip of the rhizome scales, plus other characters, to distinguish *Micropolypodium taenifolium* (= *Moranopteris taenifolia*), but the color is not always present in all specimens. *Moranopteris microlepis* is another species whose scales may vary in color (the entire body of the scale red-brown to just a few cell-walls red-brown).

Many authors have used "glandular apical cells" as a helpful character to recognize species in the *Moranopteris*. Morton (1967) utilized this feature, plus others, to distinguish *Grammitis apheloleps* (=*Moranopteris apheloleps*) from *G. truncicola* (=*Moranopteris truncicola*) and *G. taenifolium* (=*Moranopteris taenifolia*). However, this feature is not restricted to *Moranopteris* (e.g., Fig. 39F), appearing also in *Adenophorus*, *Ceradenia*, and *Melpomene* (Ranker *et al.* 2004). These apical cells seem to be easily detached by a slight touch, and so are difficult to use as a diagnostic feature in *Moranopteris*. Sundue (2010b) used the term "apical or subapical gland-like cells" and commented that these cells are very small and easily overlooked. In general these cells have thinner walls and are smaller than those of the scale body. *Moranopteris apheloleps* and *M. truncicola* sometimes have these apical cells on the rhizome scales, but in *M. taenifolia* they are always absent (Fig. 34E). *Moranopteris grisebachii* has apical cells on the rhizome scales similar to those in *Stenogrammitis* and called 'apical cilia' by Labiak (2011); therefore, in *M. grisebachii*, we refer to such a cells as apical cilia-like cells.

Laminar dissection.—For *Moranopteris* we have adopted the following terminology: pinnatifid is pinnately divided with the sinuses extending halfway between the margins and costa. Pinnatisect is also pinnately divided,

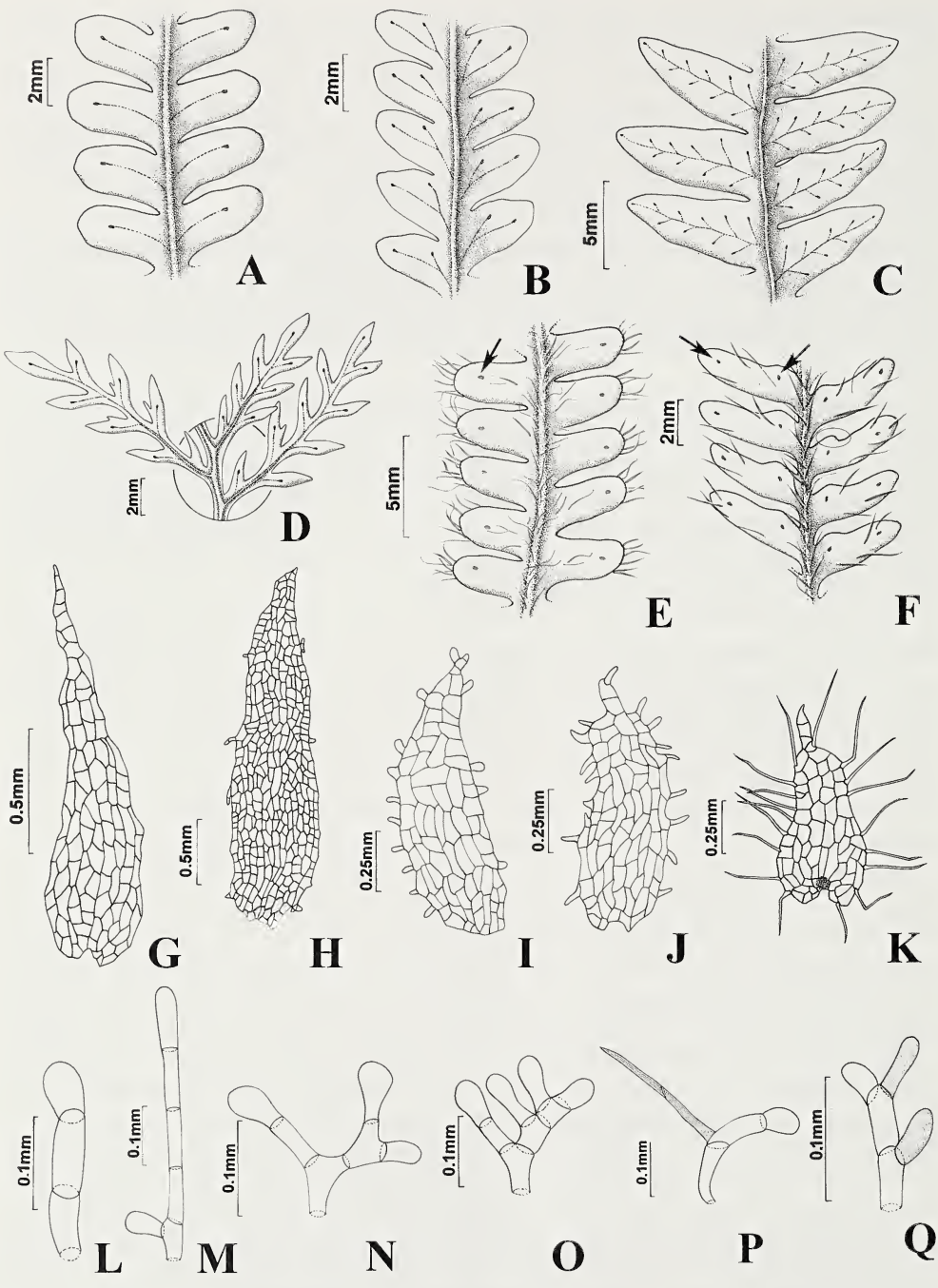

FIG. 3. Morphology of some species of *Moranopteris*. A–D: venation patterns (cleared lamina). A. simple veins, *M. cookii* (*Sundue & al. 1764*, NY). B. furcate veins, *M. apheloleppis* (*Boeke & Jaramillo 2701*, NY). C. pinnate veins, *M. gradata* (*Hirai & al. 564*, SP). D. pinnate veins, *M. longisetosa* (*Rojas 3209*, NY). E–F: segments. E. non-gibbous segments (arrow indicates adaxial hydathode), *M. cookii* (*Sundue & al. 1764*, NY). F. gibbous segments at circle (arrows indicate

TABLE 1. Geographic regions and their species of *Moranopteris*.

Main geographic regions (based on Tryon 1972)	Number of species per Region (% of total species in the genus)	Number of endemic species per Region (%)	Species (endemics in bold)
Mexican	3 (11%)	0	*M. basiattenuata*, *M. taenifolia*, *M. trichomanoides*
Central American	12 (43%)	1 (8%)	*M. basiattenuata*, *M. caucana*, *M. cookii*, *M. hyalina*, *M. longisetosa*, *M. microlepis*, *M. nana*, *M. plicata*, *M. taenifolia*, *M. trichomanoides*, *M. truncicola*, ***M. zurquina***
Greater Antilles	7 (25%)	1 (14%)	*M. basiattenuata*, *M. grisebachii*, *M. microlepis*, *M. nimbata*, ***M. sherringii***, *M. taenifolia*, *M. trichomanoides*
Lesser Antilles	7 (25%)	1 (14%)	*M. grisebachii*, ***M. knowltoniorum***, *M. microlepis*, *M. nana*, *M. serricula*, *M. taenifolia*, *M. trichomanoides*
Andean	14 (50%)	5 (36%)	***M. aphelolepis***, *M. basiattenuata*, ***M. blepharidea***, *M.caucana*, *M. cookii*, *M. hyalina*, ***M. killipii***, *M. longisetosa*, *M. nana*, *M. plicata*, ***M. simplex***, *M. taenifolia*, *M. truncicola*, ***M. williamsii***
Guianan	9 (32%)	2 (22%)	*M. basiattenuata*, *M. caucana*, ***M. liesneri***, *M. nana*, *M. plicata*, ***M. rupicola***, *M. serricula*, *M. taenifolia*, *M. truncicola*
Southeastern Brazil	4 (14%) + 1 hybrid	3 (75%) + 1 hybrid	*M. achilleifolia*, ***M. gradata***, ***M. perpusilla***, ***M. setosa***, ***M. xbradei***

but the sinuses extend more than halfway to or to the costa, and the segments are adnate and united by their bases.

Costa is adopted when the lamina is pinnatifid and/or pinnatisect; the term rachis is only used for those species with a pinnate lamina (*Moranopteris longisetosa*) or pinnate at base (*M. liesneri* and *M. williamsii*). For those species that are pinnate at the base, we simplified the description and the rachis is not described because it is very small.

←

adaxial hydathodes), *M. liesneri* (*Cowan & Wurdack 31415*, NY). G–K: rhizome scale types. G. entire margins, *M. cookii* (*Sundue & al. 1764*, NY). H. margins with small lateral projections, *M. basiattenuata* (*Breedlove & Thorne 30160*, NY). I. margins with glanduliform projections, *M. longisetosa* (*Rojas 3209*, NY). J. margins with short setiform projections, *M. killipii* (*Lehmann 7655*, K). K. margins with long setiform projections, *M. microlepis* (*Rojas 3603*, NY). L–P: some hair types (rehydrated). L. unbranched hairs, *M. liesneri* (*Cowan & Wurdack 31415*, NY). M. 1-branched, *M. blepharidea* (*Kessler & al. 11973*, UPCB). N. 2-branched, *M. longisetosa* (*Rojas 3209*, NY). O. 3-branched, *M. serricula* (*Feldmann s.n.*, P). P. 1-branched with one setiform branch, *M. taenifolia* (*Granville 3557*, CAY). Q. 2-branched, branches tinged red-brown, *M. nimbata* (*Clement 1007*, P).

Table 2. Distribution of *Moranopteris* by country in the Neotropics. Endemic species are in boldface.

Country	Number of species (number of endemics)	Species
MEXICO	3 (0)	*M. basiattenuata*, *M. taenifolia*, *M. trichomanoides*
BELIZE	1 (0)	*M. taenifolia*
GUATEMALA	4 (0)	*M. basiattenuata*, *M. cookii*, *M. taenifolia*, *M. trichomanoides*
HONDURAS	3 (0)	*M. basiattenuata*, *M. taenifolia*, *M. trichomanoides*
EL SALVADOR	1 (0)	*M. basiattenuata*
NICARAGUA	2 (0)	*M. caucana*, *M. taenifolia*
COSTA RICA	11 (1)	*M. basiattenuata*, *M. caucana*, *M. cookii*, *M. hyalina*, *M. longisetosa*, *M. microlepis*, *M. nana*, *M. plicata*, *M. taenifolia*, *M. truncicola*, ***M. zurquina***
PANAMA	5 (0)	*M. caucana*, *M. cookii*, *M. microlepis*, *M. nana*, *M. taenifolia*
CUBA	3 (0)	*M. nimbata*, *M. sherringii*, *M. trichomanoides*
JAMAICA	7 (0)	*M. basiattenuata*, *M. grisebachii*, *M. microlepis*, *M. nimbata*, *M. sherringii*, *M. taenifolia*, *M. trichomanoides*
HAITI	2 (0)	*M. taenifolia*, *M. trichomanoides*
DOMINICAN REPUBLIC	4 (0)	*M. basiattenuata*, *M. nimbata*, *M. taenifolia*, *M. trichomanoides*
PUERTO RICO	2 (0)	*M. sherringii*, *M. taenifolia*
SAINT KITTS AND NEVIS	1 (0)	*M. taenifolia*
DOMINICA	2 (0)	*M. knowltoniorun*, *M. serricula*
GUADELOUPE	6 (0)	*M. grisebachii*, *M. knowltoniorum*, *M. microlepis*, *M. serricula*, *M. taenifolia*, *M. trichomanoides*
MARTINIQUE	3 (0)	*M. grisebachii*, *M. serricula*, *M. taenifolia*
TRINIDAD AND TOBAGO	3 (0)	*M. nana*, *M. serricula*, *M. taenifolia*
FRENCH GUIANA	2 (0)	*M. nana*, *M. taenifolia*
SURINAM	2 (0)	*M. nana*, *M. taenifolia*
GUYANA	6 (0)	*M. basiattenuata*, *M. caucana*, *M. nana*, *M. rupicola*, *M. taenifolia*, *M. truncicola*
VENEZUELA	11 (2)	*M. basiattenuata*, *M. caucana*, ***M. liesneri***, *M. longisetosa*, *M. nana*, *M. plicata*, *M. rupicola*, *M. serricula*, ***M. simplex***, *M. taenifolia*, *M. truncicola*
COLOMBIA	11 (0)	*M. aphelolepis*, *M. basiattenuata*, *M. blepharidea*, *M. caucana*, *M. hyalina*, *M. killipii*, *M. longisetosa*, *M. nana*, *M. plicata*, *M. taenifolia*, *M. truncicola*
ECUADOR	10 (0)	*M. aphelolepis*, *M. basiattenuata*, *M. caucana*, *M. cookii*, *M. hyalina*, *M. killipii*, *M. longisetosa*, *M. plicata*, *M. taenifolia*, *M. truncicola*
PERU	8 (0)	*M. blepharidea*, *M. caucana*, *M. hyalina*, *M. longisetosa*, *M. nana*, *M. plicata*, *M. taenifolia*, *M. truncicola*
BOLIVIA	7 (1)	*M. aphelolepis*, *M. blepharidea*, *M. caucana*, *M. longisetosa*, *M. taenifolia*, *M. truncicola*, ***M. williamsii***
BRAZIL	9 + 1 hybrid (4)	*M. achilleifolia*, *M. caucana*, ***M. gradata***, *M. nana*, ***M. perpusilla***, *M. plicata*, ***M. setosa***, *M. taenifolia*, *M. truncicola*, ***M. xbradei***

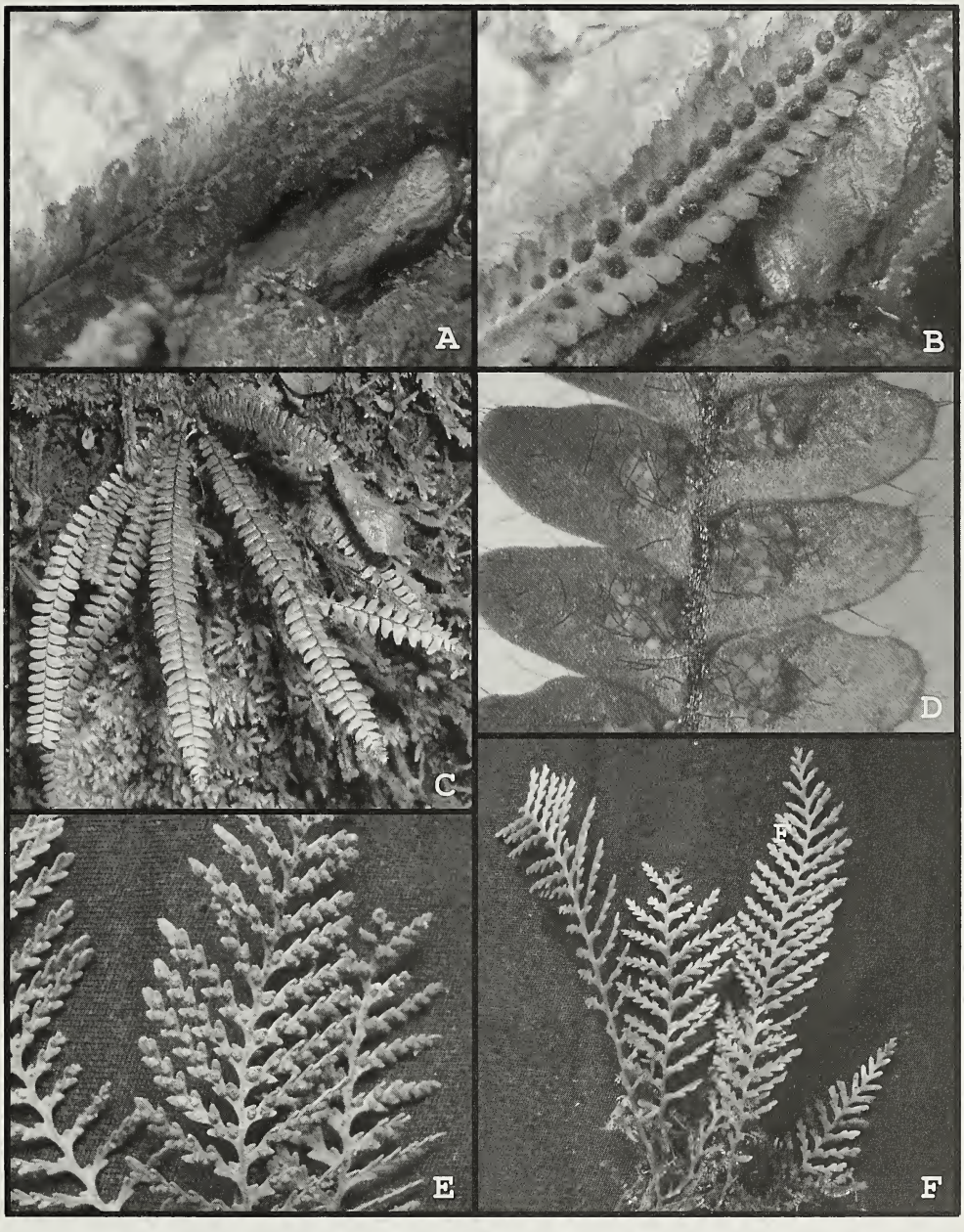

FIG. 4. Morphology of some species of *Moranopteris*. A, B. *Moranopteris truncicola* (photos by M. Sundue, Colombia, Risaralda, Pueblo Rico, 2007, *Vasco & Sundue 626*). A. Part of lamina showing setae adaxially. B. Part of lamina showing setae and sori abaxially. C, D. *M. taenifolia* (photos by R. C. Moran, Costa Rica, 2004 and 2001, without vouchers, respectively; http://www.diversityoflife.org). C. Habit with leaves, adaxial view. D. Detail of the fertile segments with sori and setae, abaxial view. E, F. *M. achilleifolia* (photos by J. Prado, Brazil, São Paulo, Campos do Jordão, 2009, *Hirai & Prado 616*). E. Part of lamina showing sori, abaxial view. F. Habit with leaves, adaxial view.

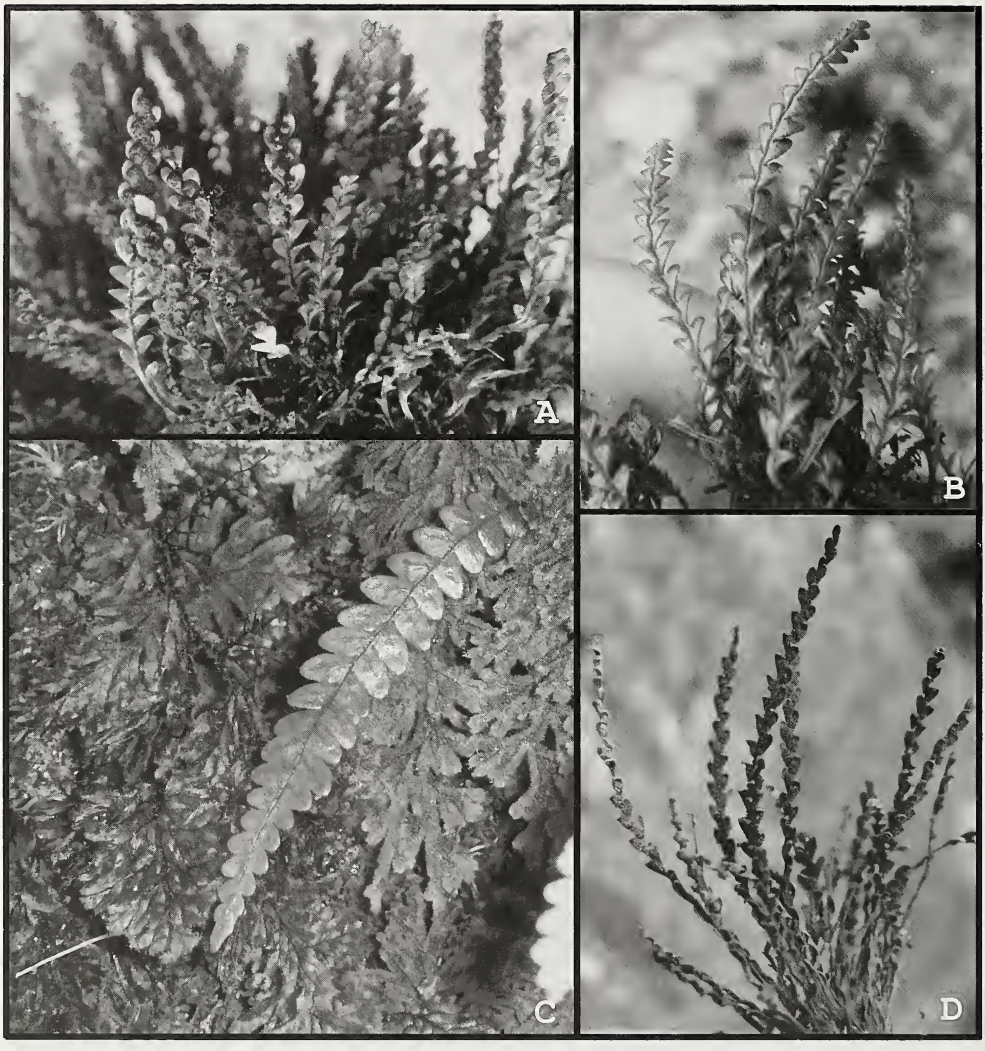

Fig. 5. Morphology of some species of *Moranopteris*. A, B. *Moranopteris perpusilla* (photos by R. Y. Hirai, Brazil, Minas Gerais, Catas Altas, 2008, *Hirai et al. 574*). A. Habit with leaves and sori, abaxial view. B. Habit with leaves, adaxial view. C. Leaf of *M. gradata*, adaxial view (photo by R. Y. Hirai, Brazil, Minas Gerais, Ouro Preto, 2008, *Hirai et al. 526*). D. Habit of *M. setosa* with leaves and sori, abaxial view (photo by J. Prado, Brazil, São Paulo, Salesópolis, 2008, *Hirai et al. 598*).

Segments.—In some species the segments may be acroscopically enlarged at their bases, i.e., possessing a lobe along the acroscopic margins of each segment. Such segments are termed gibbous (Mickel and Smith 2004, p. 400). This enlargemnet is especially visible on fertile segments (Fig. 3F) and has being used to characterize some species of *Moranopteris*. For example, Mickel and Smith (2004) used this (and other features) to distinguish *Micropolypodium trichomanoides* (= *Moranopteris trichomanoides*) from otherwise similar species (Figs. 36C, D).

HYDATHODES.—Sota *et al.* (2000) discussed the "hydathodes" of grammitid ferns. According to these authors, these structures are located at the tip of the veins and are immersed adaxially. Their epidermal cell patterns differ from that of the rest of the laminar tissue, having an ensemble of short tracheids with expanded distal portions. Bower (1928) called such tracheids "storage tracheids". These specialized cells exude water and salts; they differ from traditional hydathodes where stomata are open continuously and undergo gutation. In this study we continue to employ the term hydathode s.l., as have other authors (e.g., Proctor 1985, Smith 1992).

The number of hydathodes visible on the lamina adaxially is directly related to the number of vein ends. Basically, three categories can be recognized in *Moranopteris*: 1) one hydathode per segment (e.g., *M. cookii*, Fig. 3E); 2) two hydathodes per segment, at least, in fertile segments or sometimes one in sterile segments (e.g., *M. aphelolepis*); and 3) more than two hydathodes per segment (e.g., *M. achilleifolia*).

VEINS.—Venation is another helpful identification feature. Three types of free venation are found in *Moranopteris*: 1) simple veins (e.g., in *M. cookii*, Fig. 3A); 2) furcate veins, at least in fertile segments or sometimes simple in sterile ones (e.g., in *M. aphelolepis*, Fig. 3B); and 3) pinnate veins (e.g., in *M. achilleifolia*, Fig. 6D).

The pinnate veined *Moranopteris achilleifolia*, *M. gradata*, and *M. longisetosa* were recently placed in *Terpsichore* (*T. achilleifolia* group) by Smith (1993). Ranker *et al.* (2004) pointed out that in grammitids, venation patterns and laminar dissection are homoplastic characters and false indicators of affinity. These results were confirmed by Hirai *et al.* (2011).

SETAE.—Setae are usually stiff, straight, terete, uniseriate, and often dark red-brown hairs in which oblique cell walls are not readily visible (Smith 1992, Lellinger 2002). Setae are present in most species of *Moranopteris* on all sides of the stipes, costae, and laminar tissue (Fig. 4D). Only two species lack setae: *Moranopteris grisebachii* and *M. perpusilla* (Figs. 16A–C, 27A–C, respectively). As mentioned by Smith (1992), setae in *Micropolypodium* (in large part *Moranopteris* of this revision) also appear to differ from setae of many other grammitid ferns in having a ring of cells at their base. These cells are different from the adjacent surrounding epidermal cells, as in *M. basiattenuata* and several other species examined. In neotropical species of *Moranopteris*, these cells may be conspicuous or inconspicuous.

HAIRS.—According to Sota (1966), hairs are good characters to distinguish grammitid ferns at species level by their diversity and constancy. He categorized the hairs into three basic types: 1) unbranched hairs; 2) branched hairs; and 3) mixed hairs (with setiform branches).

In *Lellingeria*, Smith *et al.* (1991) described the hairs as mostly having a short basal cell that forks, giving rise to two cells: one short, lateral, and apparently glandular, the other usually longer, oblique, and acicular. Rarely, the short lateral cell bears a second long-acicular cell. Although most species of *Lellingeria* produce forked hairs, several species also have hairs that (apparently) are unbranched.

Smith (1995) described the species of *Micropolypodium s.l.* with simple, glandular branched, or only branched hairs. He applied the term glandular branched to *M. trichomanoides*, *M. truncicola*, and *M. zurquinum* (= *Moranopteris*, Figs. 36G, 37F, 39G, respectively). Lehnert (2008) used the term "clavate hairs" to species of the grammitid genus *Melpomene*. These hairs are minute, simple and branched, and pluricellular; they are pale in color and bear clavate cells at their apices or along their length. Lehnert did not observe a secretive function in hairs of *Melpomene*.

Labiak *et al.* (2010a) described the grammitid genus *Leucotrichum* based on a similar concept as proposed by Smith (1992), but for hairs where the shorter cell is glandular. The hair shown in Fig. 2F3 (Labiak *et al.* 2010a), a species of *Leucotrichum*, is similar to a branched hair with a setiform branch in *Moranopteris taenifolia* (Fig. 3P). Smith *et al.* (1991) originally segregated *Lellingeria s.l.* from *Grammitis* based in part upon the presence of distinctive three-celled, once- to twice-furcate hairs that bear hyaline acicular branch cells. According to Labiak *et al.* (2010a), this hair type should be interpreted as convergent, having evolved multiple times in the grammitid clade.

For the present study, the classification by Sota (1966) was adopted with few modifications, because his system seems to be clearer than those of other authors. Based on Sota (1966), we recognize the following types of hairs in *Moranopteris*:

1) *Unbranched hairs*: uniseriate, hyaline, slightly catenate, mostly red-brown on the cross walls, 1–6-celled, with a rounded or clavate apical cell, the latter glandular or not (Fig. 20F).
2) *Branched hairs*: 1–4-branched, hyaline, slightly catenate, mostly red-brown on the cross walls, branches mostly with rounded or clavate terminal cells (Fig. 32H) or the branch itself setiform (Fig. 3P), rarely slightly acicular (*M. grisebachii*, Fig. 16F). The terminal cells may be glandular or not. Typically, some branched hairs have the first branch at least twice as long as the main branch, as in *M. cookii* and *M. hyalina* (Figs. 13F, 17G, respectively). Sometimes, the hair branches have a red-brown tinge, as in *Moranopteris nimbata* (Fig. 3Q).

Variation in the morphology of the hairs appears to be a useful feature for recognizing species of *Moranopteris*, especially for the group of species with rhizome scales having setiform projections on the margins.

Phylogenetic studies.—Hirai *et al.* (2011) conducted a phylogenetic study that included many species of *Moranopteris*. In the taxonomic treatment of the genus presented here, we comment on species we believe, on the basis of morphology, to be closely related. Putative relationships among morphologically similar species can be seen in the phylogeny by Hirai *et al.* (2011). However, in that study it was not possible to elucidate the relatioships among *Moranopteris* species, because there were too few specimens of each species and the markers sequenced showed insufficient variation.

Taxonomic treatment

Twenty eight species and one hybrid are here recognized for the genus in the Neotropics. A key to those species is presented below.

Moranopteris R. Y. Hirai & J. Prado, Taxon 60: 1127. 2011. Type.— ***Moranopteris basiattenuata*** (Jenman) R. Y. Hirai & J. Prado, Taxon 2011. *Polypodium basiattenuatum* Jenman, Bull. Bot. Dept. Jamaica, n.s. 4: 114. 1897. **Figs. 3–5.**

Plants epiphytic, rarely epipetric or terrestrial. *Rhizomes* short-creeping, decumbent to ascending, slightly dorsiventral to radially symmetric, scales golden to castaneous, often lustrous, nonclathrate, the cells of the scales' body turgid and shining, margins entire or bearing small, hyaline, lateral projections, or with glanduliform or setiform projections, the setiform projections mostly red-brown, rarely hyaline, apical or subapical gland-like cells present or not. *Leaves* monomorphic, caespitose, erect to pendent, determinate, or rarely ± indeterminate (*M. caucana* and *M. killipii*), short-stipitate, sometimes the stipes almost absent, not articulate to the rhizomes; *laminae* mostly linear, sometimes lanceolate, pinnatifid or pinnatisect, rarely bipinnatisect or pinnate-pinnatisect, sometimes pinnate only at base, gradually tapering proximally to a narrow lateral wing or not, mostly chartaceous, sometimes membranaceous; *costae* obscured by greenish laminar tissue or overlain by dark sclerenchyma abaxially and adaxially; *segments* ascending to patent, alternate to opposite, with an acroscopic hump (segments gibbous) or not, especially in fertile segments, entire, oblong or rounded, rarely linear and pinnatisect or pinnatifid (*M. achilleifolia*), slightly decurrent at base or not, margins plane or slightly revolute, sometimes hyaline marginally, basiscopic edge not folded over sorus; *veins* simple or furcate, rarely pinnate, inconspicuous, obscured by the laminar tissue or by dark sclerenchyma at the bases of the segments; *hydathodes* present, mostly 1 or 2 (rarely > 2) per segment or pinna, visible adaxially, round to linear; *setae* dark red-brown, present on all sides of the stipes, rachises and/or costae, also sometimes on laminar tissue (rarely absent), a ring of cells at base of each seta conspicuous to inconspicuous; *hairs* present on stipes, rachises, and/or costae, also on laminar tissue (mainly near costae abaxially), these hyaline, slightly red-brown, unbranched or mostly branched. *Sori* superficial, usually at base of the costae/costules or on the acroscopic veinlet, mostly 1 (rarely > 2) per segment or pinna, round or elliptic, exindusiate; soral paraphyses absent; *sporangia* glabrous; *spores* tetrahedral-globose, papillate to tuberculate with small globules; $x=37$ (Walker 1985, Smith 1992).

Key to the species

1. Veins pinnate (Fig. 3C, D); sori more than 2 per segment
   2. Rhizome scales with glanduliform projections on the margins (Fig. 3I); laminae pinnate-pinnatisect, sometimes pinnate-pinnatifid . . . . . **13. M. longisetosa**
   2. Rhizome scales with entire margins (Fig. 3G) or with small lateral projections (Fig. 3H); laminae pinnatisect (Fig. 3C) or pinnatisect-pinnatifid, or bi-pinnatisect (Fig. 3D)
      3. Segments pinnatisect (Fig. 3D) or pinnatifid, linear . . . . . **1. M. achilleifolia**
      3. Segments entire (Fig. 3C), deltate to deltate-lanceolate . . . . . **7. M. gradata**
1. Veins simple (Fig. 3A) or furcate (Fig. 3B); sori 1 per segment
   4. Rhizome scales with short (Fig. 3J) or long (Fig. 3K) setiform projections on the margins, these hyaline to yellowish or red-brown
      5. Rhizome scales with hyaline or yellowish setiform projections on the margins . . . **9. M. hyalina**

5. Rhizome scales with red-brown setiform projections on the margins
   6. Veins simple (Fig. 3A) and with 1 hydathode (Fig. 3E) per segment in fertile segments, visible adaxially
      7. Costae abaxially with hairs 2- or 3-branched (Fig. 3N, O). . . . . **18. M. plicata**
      7. Costae abaxially with 1-branched hairs bearing the first branch at least twice as long as the main branch (Fig. 3M)
         8. Leaves seemingly indeterminate; segments deltate, 48–69 pairs . . . **5. M. caucana**
         8. Leaves determinate; segments oblong, 27–45 pairs. . . . . **6. M. cookii**
   6. Veins furcate (Fig. 3B) and with 2 hydathodes (Fig. 3F) per segment in fertile segments, visible adaxially
      9. Rhizome scales with short setiform projections (Fig. 3J); abaxial costal hairs 1-branched, with the first branch at least twice as long as the main branch (Fig. 3M). . . . . **10. M. killipii**
      9. Rhizome scales with long setiform projections (Fig. 3K); abaxial costal hairs 1-branched, lacking a longer branch, or with setiform branch, or hairs 2-(3-)branched (Fig. 3N, O), or with unbranched hairs (Fig. 3L)
         10. Costae abaxially with unbranched hairs (Fig. 3L) and 1-branched hairs with setiform branch (Fig. 3P), or with unbranched hairs
            11. Plants exclusively epipetric; segments linear (3F); plants endemic to Venezuela. . . . . **12. M. liesneri**
            11. Plants epiphytic (*M. nana* rarely epipetric); segments ovate, oblong to lanceolate (Fig. 3B), sometimes deltate; plants widely distributed in Neotropics
               12. Rhizome scales with setiform projections mostly on distal third of the margin; segments ovate to oblong, sometimes deltate, 1.2–1.7 mm apart (segments rarely closer) . . . . . **15. M. nana**
               12. Rhizome scales with setiform projections along margins (Fig. 3K); segments ovate to lanceolate, 0.4–1.0 mm apart. . . . . **24. M. taenifolia**
         10. Costae abaxially with unbranched hairs and 2-(3-)branched hairs (Fig. 3N, O)
            13. Plants exclusively epipetric; costae partially visible adaxially. . . . . **19. M. rupicola**
            13. Plants epiphytic (*M. nana* rarely epipetric); costae completely obscured by laminar tissue adaxially
               14. Segments gibbous (Fig. 3F)
                  15. Rhizome scales with setiform projections along margins, these 0.3–0.5 mm long; leaves mostly densely setose . . . . . **14. M. microlepis**
                  15. Rhizome scales with setiform projections mostly on distal third, these 0.1–0.2 mm long (rarely 0.3 mm long); leaves mostly sparsely setose . . . . . **15. M. nana**
               14. Segments not gibbous (Fig. 3E) (rarely gibbous in *M. plicata*)
                  16. Branched hairs on abaxial costae surfaces mostly with branches tinged red-brown (Fig. 3Q); plants endemic to the Greater Antilles (Cuba, Dominican Republic, and Jamaica) . . . . . **16. M. nimbata**
                  16. Branched hairs on abaxial costae surfaces mostly hyaline or slightly red-brown on cross walls; plants from Central and South America
                     17. Segments ascending, 45–60° to costae, 10–29 pairs . . . **18. M. plicata**
                     17. Segments ascending, 65–80° to costae, 30–61(–70) pairs . . . . . **26. M. truncicola**

4. Rhizome scales with entire margins (Fig. 3G) or small lateral projections (Fig. 3H)
   18. Leaves without setae
      19. Roots proliferous; laminae membranaceous; segments gibbous; plants endemic to the Caribbean . . . . . **8. M. grisebachii**
      19. Roots not proliferous; laminae chartaceous; segments not gibbous; plants endemic to SE Brazil. . . . . **17. M. perpusilla**
   18. Leaves with setae
      20. Veins simple, 1 hydathode per segment

21. Segments patent, 80–90° to costae; abaxial costal hairs 1-branched with the first branch at least twice as long as the main branch . . . . . **6. M. cookii**
21. Segments ascending, 40–60°(–70); abaxial costal hairs 1-branched without a longer branch, or with hairs 2- or 3-branched (Fig. 3N, O)
22. Rhizome scales ovate to oblong; segments gibbous; plants endemic to Bolivia . . . . . **27. M. williamsii**
22. Rhizome scales lanceolate to slightly linear; segments not gibbous; plants endemic to Costa Rica . . . . . **28. M. zurquina**

20. Veins furcate; 2 hydathodes per segment
23. Segments acroscopically gibbous, lobes rarely inconspicuous
24. Stipes (0.7–)1.3–3.5 cm long; leaves densely setose. . . . . **2. M. aphelolepis**
24. Stipes 0.05–0.35 cm long (rarely to 2.0 in *M. trichomanoides*); leaves moderately setose
25. Hairs scattered all along the costae and laminar tissue abaxially and along laminar margins; plants endemic to Venezuela . . . . . **23. M. simplex**
25. Hairs concentrated on and near costa abaxially; plants from Mexico, Central America, and Caribbean
26. Laminae membranaceous; hairs 1- or 2-branched, the first branch at least twice as long as the main branch (Fig. 3M). . . **11. M. knowltoniorum**
26. Laminae chartaceous; hairs (1-)2- or 3-(4-) branched (Fig. 3N, O), the first branch not longer than the main branch . . . . . **25. M. trichomanoides**

23. Segments not gibbous
27. Costae abaxially with hairs 1-branched, these with the first branch at least twice as long as the main branch
28. Segments oblong to oblong-lanceolate, apices slightly rounded to truncate . . . . . **3. M. basiattenuata**
28. Segments deltate-lanceolate, apices mostly acute . . . . . **4. M. blepharidea**
27. Costae abaxially with hairs 1-branched, these without a longer branch or with mostly 2- or 3-branched hairs
29. Rhizome scales ovate; segments ascending, 20°–35° to the costae; plants endemic to S. Brazil . . . . . **21. M. setosa**
29. Rhizome scales lanceolate; segments ascending, 45°–60° to the costae; plants from the Caribbean and Guianan regions
30. Leaves 7.5–18.5 cm long; laminae with 18–63 pairs of deltate segments. . . . . **20. M. serricula**
30. Leaves 3.5–4.5 cm long; laminae with 6–12 pairs of oblong segments. . . . . **22. M. sherringii**

Species Treatments

1. ***Moranopteris achilleifolia*** (Kaulf.) R. Y. Hirai & J. Prado, Taxon 60: 1128. 2011. *Polypodium achilleifolium* Kaulf., Enum. Fil. 116. 1824. *Ctenopteris achilleifolia* (Kaulf.) J. Sm., Hist. fil. 185. 1875. *Grammitis achilleifolia* (Kaulf.) R. M. Tryon & A. F. Tryon, Rhodora 84: 128. 1982. *Terpsichore achilleifolia* (Kaulf.) A. R. Sm., Novon 3: 486. 1993. *Micropolypodium achilleifolium* (Kaulf.) Labiak & F. B. Matos, Brittonia 59: 184. 2007. TYPE.—BRAZIL. "Habitat in Brasilia, Otto communicaviti", s.d., *collector unknown* (holotype: probably at B), *ex descr.* **Figs. 4E, F, 6, 7A.**

Plants epiphytic or epipetric, rarely terrestrial. *Rhizomes* short-creeping with scales 1.5–2.2 × 0.2–0.4 mm, these golden, rarely castaneous, linear to linear-lanceolate, bases truncate to slightly cordate, apices attenuate, margins

Fig. 6. *Moranopteris achilleifolia*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Unbranched and branched hairs (rehydrated) from costa. A–C: *Hirai & Schwartsburd 608* (SP); D–F: *Hirai et al. 601* (SP).

entire, or rarely with small lateral projections. *Leaves* erect to arcuate, determinate, 4.8–17.5 × 1.0–3.4 cm, sparsely setose; *stipes* 0.5–3.2 cm long, yellowish or sometimes slightly dark-brown at bases, wings absent; *laminae* lanceolate, pinnatisect-pinnatifid to bipinnatisect, rarely pinnate at bases, gradually tapering proximally, chartaceous; *costae* obscured by laminar tissue abaxially and adaxially, sometimes weakly visible with dark sclerenchyma abaxially; *segments* ascending, (30–)50–70° to costae, 10–27 pairs, 1.0–3.0 mm apart, alternate, not gibbous, symmetric, 4.0–18.0 × 0.9–4.0 mm, linear, pinnatisect or pinnatifid, slightly decurrent, apices rounded, margins plane or slightly revolute, without hyaline cells; *veins* pinnate, inconspicuous, > 2 hydathodes per segment, elliptic to round, sometimes linear; *setae* 0.3–0.9 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on stipes, costae, veins, and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, unbranched and branched, the unbranched hairs (1-)2- or 3-celled, ca. 0.2 mm long, the branched hairs (1-)2- or 3-branched, mostly 2-branched, the main branch (2-)3-(4-)celled, ca. 0.2 mm long, 1st and 2nd branches 1- or 2-(3-)celled, < 0.1 mm long. *Sori* 2 or more per segment, round to elliptic, 0.7–1.5 mm diam.

Distribution.—Coastal Brazil (Bahia, Espírito Santo, Minas Gerais, Paraná, Rio de Janeiro, Rio Grande do Sul, Santa Catarina, and São Paulo); 700–2500 m.

Selected Specimens Examined.—BRAZIL. **Bahia**: Arataca, Serra do Peito de Moça, estrada que liga Arataca à Una, ramal ca. 22,4 km de Arataca com entrada no Assentamento Santo Antônio, RPPN "Caminho das Pedras", 900 m, 15°10′25″S, 39°20′30″W, 6 Aug 2006, *Labiak et al. 3642* (NY). **Espírito Santo**: Castelo, Forno Grande, 1500 m, 15 May 1949, *Brade 19980* (RB). **Minas Gerais**: Araponga, Parque Estadual da Serra do Brigadeiro, trilha para o Pico do Boné, 26 May 2000, *Salino et al. 5514* (BHCB, SP). **Paraná**: Campina Grande do Sul, Serra do Capivari, subida para a estação da Embratel, 1400 m, 25°08′S, 48°49′W, 26 Dec 2008, *Hirai & Schwartsburd 608* (NY, SP, VT). **Rio de Janeiro**: Itatiaia, Parque Nacional do Itatiaia, trilha para o morro Três Picos, Jun 2000, *Labiak et al. 1249* (MBM, UPCB). **Rio Grande do Sul**: Aparados da Serra, 1000 m, 3 Feb 1953, *Sehnem 6276* (B). **Santa Catarina**: Campo Alegre, Serra Quiriri, próximo à torre de rádio, 1400 m, 28 Dec 1999, *Cordeiro et al. 1725* (MBM). **São Paulo**: Salesópolis, Estação Biológica de Boracéia, 800 m, 23°40′S, 45°53′W, 10 Dec 2008, *Hirai et al. 601* (NY, SP, VT).

Moranopteris achilleifolia is characterized by short-creeping rhizomes, rhizome scales with entire margins, pinnatisect-pinnatifid to bipinnatisect laminae, pinnate veins ending in hydathodes, and more than two sori per segment (Figs. 6A–E).

The most similar species is *Moranopteris longisetosa*, which differs in having margins of the rhizome scales with glanduliform projections and pinnate-pinnatisect laminae, sometimes pinnate-pinnatifid. Additionally, *Moranopteris longisetosa* does not occur in Brazil. It is known from Costa Rica, Venezuela, Colombia, Ecuador, Peru, and Bolivia.

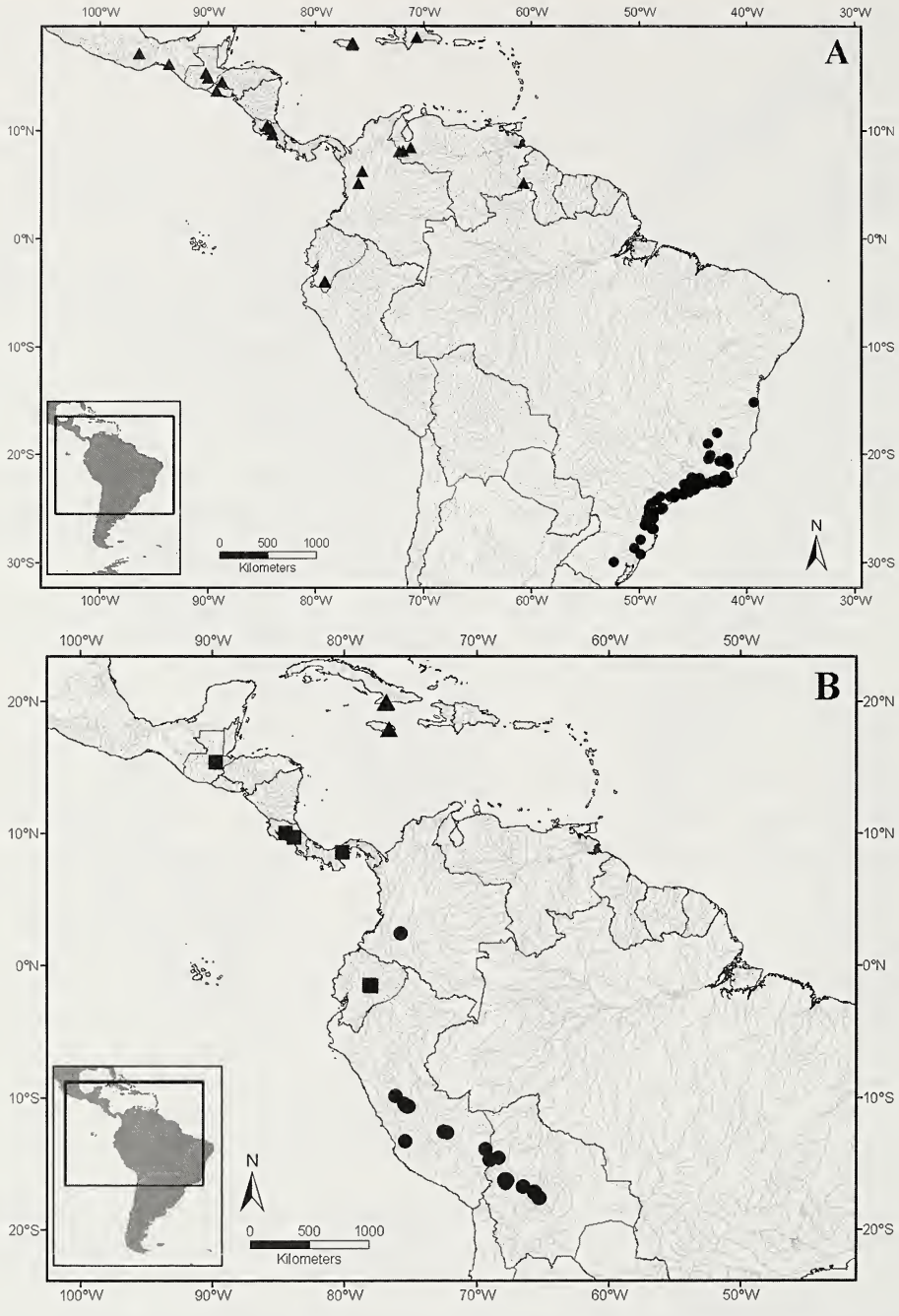

Fig. 7. A. Distribution of *Moranopteris achilleifolia* (●) and *M. basiattenuata* (▲). B. Distribution of *M. blepharidea* (●), *M. cookii* (■), and *M. sherringii* (▲).

Sehnem (1970) and Ponce (2008) reported this species for Prov. Missiones (Argentina), but the vouchers cited by both authors were not found in HBR and PACA. No specimen from Argentina has been seen.

2. *Moranopteris aphelolepis* (C. V. Morton) R. Y. Hirai & J. Prado, Taxon 60: 1128. 2011. *Grammitis aphelolepis* C. V. Morton, Contr. U.S. Natl. Herb. 38: 97. 1967. *Xiphopteris aphelolepis* (C. V. Morton) Pic. Serm., Webbia 28: 472. 1973. *Micropolypodium aphelolepis* (C. V. Morton) A. R. Sm., Novon 2: 422. 1992. TYPE.—ECUADOR. **Azuay**: Oriente border, Páramo del Castillo, crest of the eastern cordillera on the trail between Sevilla de Oro and Mendez, 29 Aug 1945, *W. H. Camp E-5107* (holotype: US-2080287; isotype: NY-144934). **Figs. 8, 9A.**

Plants epiphytic. *Rhizomes* erect with scales 1.6–3.2 × 0.4–0.7 mm, these yellow-brown to castaneous, lanceolate to ovate-lanceolate, bases cordate to slightly cordate, apices acute, usually with apical or subapical gland-like cells, margins entire, or with small lateral projections, these projections sometimes furcate, rarely occurring on the scale surfaces. *Leaves* erect to pendent, determinate, (5.0–)7.0–18.5 cm × (4.0–)5.0–11.0 mm, densely setose; *stipes* (0.7–)1.3–3.5 cm long, brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, sometimes deeply pinnatifid, gradually tapering proximally to a narrow wing, chartaceous to membranaceous; *costae* visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, (45–)60–75°(–80) to costae, 21–55 pairs, 0.5–1.4 mm apart, subopposite, mostly gibbous, asymmetric, (2.1–)2.5–5.5 × (1.3–)1.5–3.2 mm, oblong, deltate toward laminar bases, decurrent, apices rounded, sometimes acute, margins plane, with hyaline cells inconspicuous or absent; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2(–4) hydathodes per segment, elliptic; *setae* 1.4–2.7 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on stipes, costae, and laminar tissue (mainly near costae abaxially), sometimes on margins, hyaline to yellowish, slightly red-brown, mostly 2–4-branched, the main branch 3–5-celled, 0.10–0.25 mm long, 1st branch (1-)2–5-celled, 0.15–0.25 mm long, 2nd and 3rd branches mostly 2–4-celled, the 2nd branch 0.15–0.25 mm long, the 3rd branch < 0.1 mm long, 4th branch, if present, 1- or 2-celled, < 0.1 mm long. *Sori* one per segment, round, 0.9–1.7 mm diam.

Distribution.—Colombia, Ecuador, and Bolivia; 2100–3700 m.

Selected Specimens Examined.—COLOMBIA. **Antioquia**: Bolívar, Corregimiento San Bernardo de los Farallones, Farallones del Citará, sector La Peña, base del cerro Cabeza de Índio, 3220–3550 m, 5°46′19″N, 76°03′13″W, 11 Nov 2004, *Rodríguez et al. 4723* (HUA). **Huila**: Cordillera Central, Cordillera del Buey, hike from Finca Loyola over the páramo down to San Antonio, 2100–3000 m, 14 Dec 1972, *Bishop 1972* (UC). **Putumayo**: Santiago, Vereda de San Antonio de Bellavista, Páramo del Bordoncillo, 3200–3400 m, 4–5 Apr 1992, *Ramírez 4726* (US).

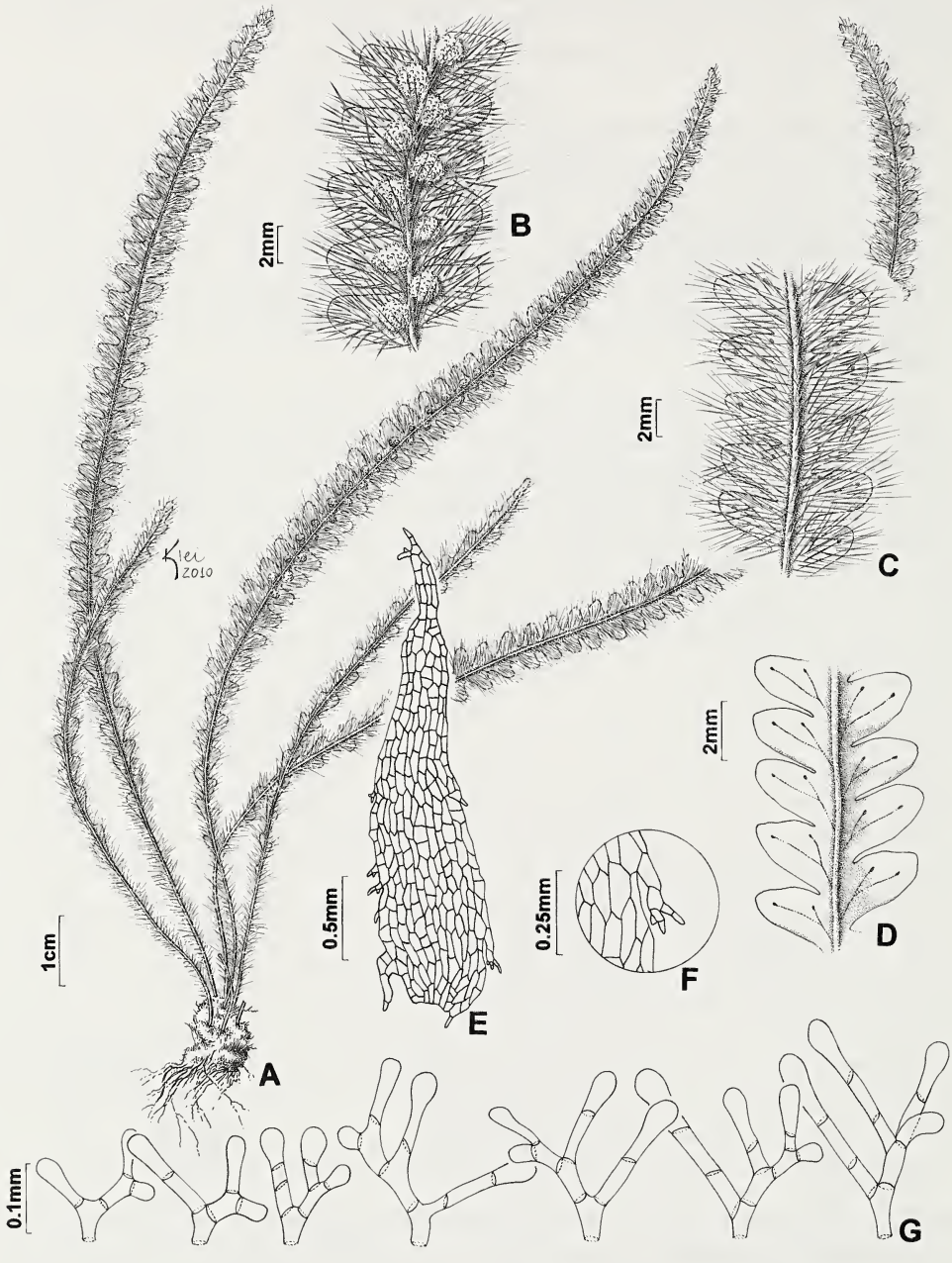

Fig. 8. *Moranopteris apheloleps*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Margin of rhizome scale. G. Branched hairs (rehydrated) from costa. A–C: *Rodríguez et al. 4723* (HUA). D, G: *Boeke & Jaramillo 2701* (NY). E, F: *Moran et al. 6870* (NY).

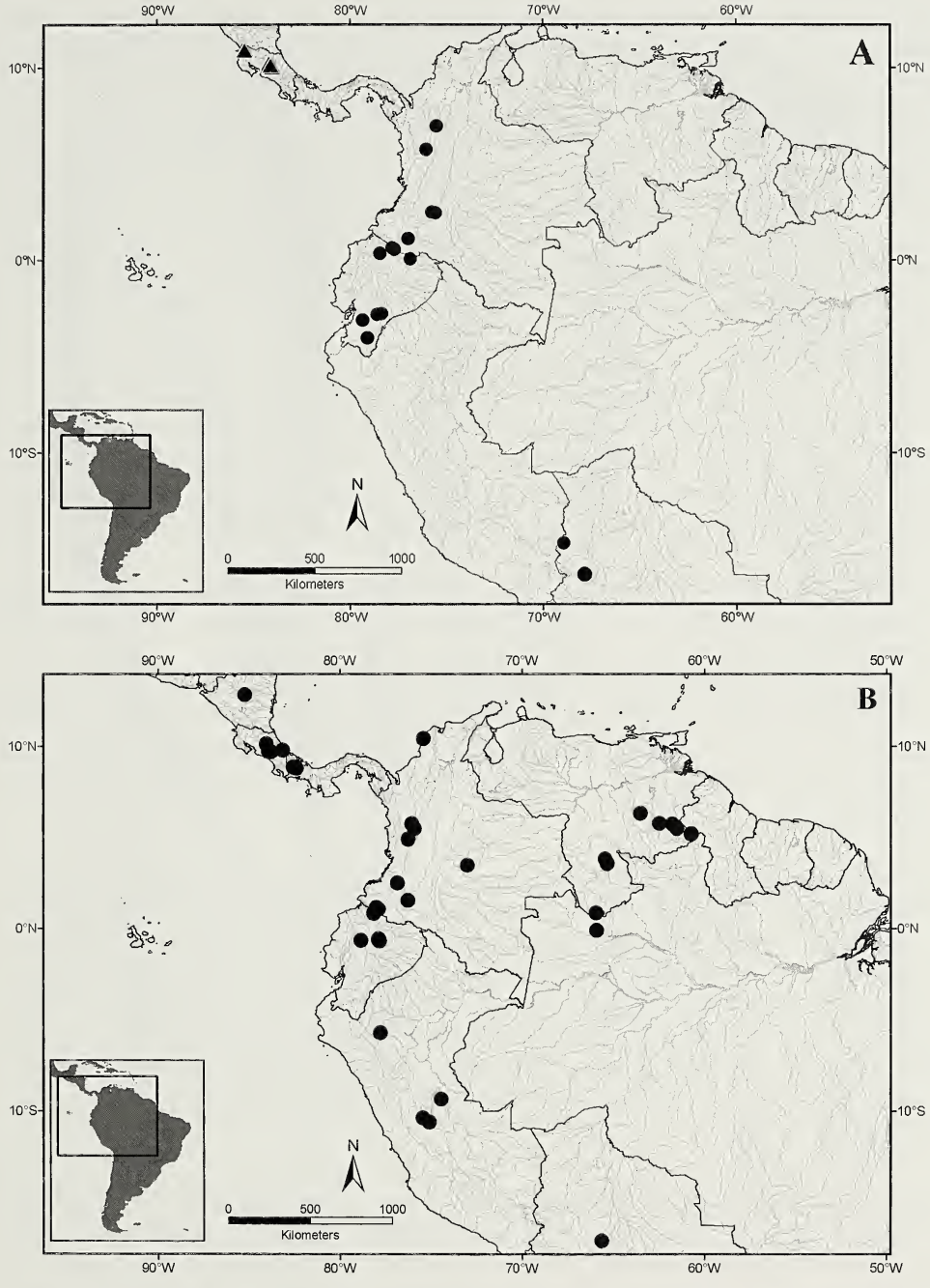

FIG. 9. A. Distribution of *Moranopteris apheloleppis* (●) and *M. zurquina* (▲). B. Distribution of *M. caucana* (●).

ECUADOR. **Azuay**: Between Huagrarancha and Loma de Galápagos, 3140–3505 m, 9 Jul 1943, *Steyermark 53464* (NY, US). **Carchi**: Estación Biológica La Guandera, 3310 m, 00°35′N, 77°42′W, 18 Feb 2004, *Moran et al. 6870* (MO, NY). **Imbabura**: Ridge about 10 km, south of Las Toldadas, easterly from Cayambe Peak, 3246 m, 15 Jul 1944, *Wiggins 10402* (US). **Napo**: Playon de San Francisco, El Mirador, 16 Aug 1978, *Boeke & Jaramillo 2701* (NY). **Sucumbíos**: Cerro "El Mirador", 4 km al SW de la población de "Cocha Seca", subiendo por el sector de "Chozas Viejas",3300–3500 m, 29 Feb 1992, *Gavilanes & Funk 838* (US). **Zamora-Chinchipe**: Estación Científica San Francisco, above refuge, along trail T1, 2550 m, 03°59′33″S, 79°04′15″W, 29–30 Sep 2003, *Lehnert 935* p.p. (UC).

BOLIVIA: **La Paz**: Cotapata, Sud Yungas, north on trail on side of mountain, 3200 m, 16°15′S, 67°50′W, 8 Aug 1989, *Fay & Fay 2602* (LPB, MO).

Moranopteris apheloleps can be recognized by an assemblage of characters: rhizome scales with entire margins, densely setose leaves, usually furcate veins, gibbous segments, two hydathodes per segment, and branched hairs (Figs. 8A–G). Some specimens from Colombia are densely setose and resemble a caterpillar.

Gavilanes & Funk 838 (US) is somewhat atypical in having three or four hydathodes per segment, but in other features matches *Moranopteris apheloleps* perfectly.

Moranopteris knowltoniorum is similar in the general aspect of the leaves, but differs by having branched hairs near and on the costae abaxially (Fig. 19G). These branched hairs mostly have the first branch at least twice as long as the main branch. It occurs only in the Lesser Antilles (Guadeloupe and Dominica).

3. ***Moranopteris basiattenuata*** (Jenman) R. Y. Hirai & J. Prado, Taxon 60: 1128. 2011. *Polypodium basiattenuatum* Jenman, Bull. Bot. Dept. Jamaica, n.s. 4: 114. 1897. *Xiphopteris basiattenuata* (Jenman) Copel., Amer. Fern J. 42: 104. 1952. *Grammitis basiattenuata* (Jenman) Proctor, Bull. Inst. Jamaica, Sci. Ser. 5: 32. 1953. *Micropolypodium basiattenuatum* (Jenman) A. R. Sm., Novon 2: 422. 1992. LECTOTYPE.—first step designated by Smith (1995) and second step designated by Hirai et al. (2011).—JAMAICA. Without exact locality, s.d., *G. S. Jenman s.n.* (NY-127117, isolectotype: NY-s.n.). **Figs. 3H, 7, 10.**

Grammitis basiattenuata (Jenman) Proctor var. *valens* Mickel & Beitel, Mem. New York Bot. Gard. 46: 197. 1988. TYPE.—MEXICO. **Oaxaca**: Distrito Ixtlán, 2 km E of Natividad, on lower part of trail from San Pedro Nolasco to the Llano Verde, 1828–2072 m, 4 Oct 1969, *J. T. Mickel & R. L. Hellwig 3824* (holotype: NY-144937).

Plants epiphytic. *Rhizomes* erect with scales 1.2–2.3 × 0.2–0.4 mm, these orangish-brown to castaneous, lanceolate, bases slightly cordate to truncate, apices acute, usually with apical cells, margins with small lateral

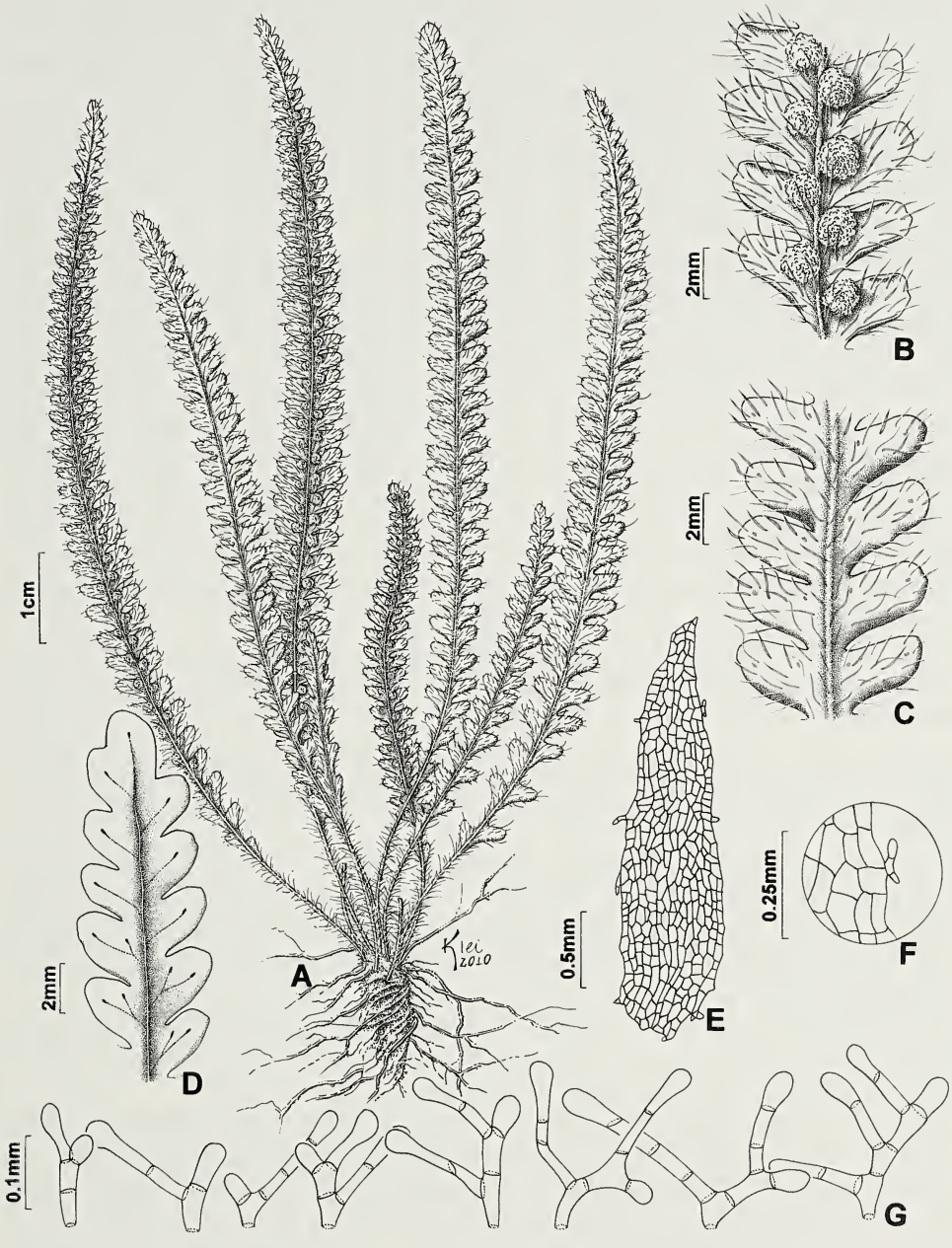

FIG. 10. *Moranopteris basiattenuata*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Margin of rhizome scale. G. Branched hairs (rehydrated) from costa. A–C: *Harris 7141* (NY). D–G: *Breedlove & Thorne 30160* (NY).

projections, these rarely furcate. *Leaves* erect to arcuate, determinate, 4.0–15.5(–21.0) cm × 4.5–9.0 mm, moderately to densely setose; *stipes* 0.5–1.2 cm long, brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, sometimes deeply pinnatifid in small plants (ca. 5 cm long), gradually tapering proximally to a narrow wing, chartaceous; *costae* visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, 45–60° to costae, 17–52 pairs, 0.4–1.1 mm apart, subopposite, not gibbous, symmetric, 1.9–5.1 × 1.1–2.3 mm, oblong to oblong-lanceolate, deltate toward laminar bases, decurrent, apices slightly rounded to truncate, margins plane, without hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, elliptic to obovate; *setae* 1.3–3.0 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* scattered on stipes, costae, laminar tissue abaxially, and margins, hyaline, slightly red-brown, 1- or 2-(3-)branched, the main branch 2- or 3-(4-)celled, (0.05–)0.10(–0.25) mm long, the 1-branched hairs with the first branch at least twice as long as the main branch, 1st branch (1-)2- or 3-(4-)celled, (0.15–)0.20–0.25 mm long, 2nd branch 1–3-celled, ca. 0.15 mm long, 3rd branch, if present, 2-celled, ca. 0.15 mm long. *Sori* one per segment, round, 1.1–1.4 mm diam.

Distribution.—Mexico, Guatemala, Honduras, El Salvador, Costa Rica, Jamaica, Dominican Republic, Guyana, Venezuela, Colombia, and Ecuador; 1700–2900 m.

Selected Specimens Examined.—MEXICO. **Chiapas**: On the southeast side of Cerro Tres Picos and the ridges near summit, 2100–2500 m, 11 Dec 1972, *Breedlove & Thorne 30160* (NY).

GUATEMALA. **Alta Verapaz**: San Juan Chamelco, Montaña Caquipec, 2100–2200 m, 15°23′52″N, 90°11′47″W, 10 Apr 1998, *Förther et al. 10135a* (MSB). **El Progresso**: Chilasco San Agustín Acasaguastlán, Sierra de las Minas, microcuenca del Río El Naranjo, laderas del Pinalón, 1900–2800 m, Apr 1997, *Vargas 695* (UC).

HONDURAS. **Lempira**: Celaque National Park, along Río Arcágual, upstream from base camp 2, 10.5 km WSW of the town of Gracias, 2500 m, 14°34′05″N, 88°41′05″W, 16 Nov 1991, *Moran 5580* (NY, UC).

EL SALVADOR. Bosque Montecristo, 2300 m, 7 Apr 1979, *Seiler 1135* (NY).

COSTA RICA. **Alajuela**: Volcán Poas summit area and lake, 2500–2650 m, 6 Jul 1967, *Bishop 811* (UC). **Heredia**: Vara Blanca, 2000 m, 3 Mar 1932, *Kupper 647* (M). **San José**: Ca. 10 km N of San Rafael de Heredia on Volcán Barba, 1950 m, 13 Jul 1967, *Mickel 2666* (NY).

JAMAICA. **Portland**: Summit of Blue Mountain Peak, 2100–2200 m, 7–9 Jul 1926, *Maxon 9858* (NY, PH, S, UC); Blue Mountain Peak, 2261 m, 30 Apr 1898, *Harris 7141* p.p. (NY).

DOMINICAN REPUBLIC: **La Vega**: Cordillera Central, La Nevera, 41.7–43.7 km N of central park of San José de Ocoa on the road to Constanza, 2042 m, 22 Fev 1982, *Mickel et al. 8339* (NY).

GUYANA. **Cuyuni-Mazaruni**: Slopes Mount Roraima, Oct 1894, *Quelch & McConnell 49* (K).

VENEZUELA. **Mérida**: Carretera de Bailadores a La Grita vía El Portachuelo, 3 km del cruce a las porqueras, 2900 m, 08°10′51″N, 71°54′16″W, 30 May 2008, *Vasco et al. 823* (NY). **Táchira**: Faldas debajo del Páramo de Tamá, cerca de la frontera Colombo-Venezolana, arriba de Betania y Tamá, cerca de la Quebrada Buena Vista, 2300–2450 m, 22–24 May 1967, *Steyermark & Dunsterville 98720* (NY).

COLOMBIA. **Antioquia**: Medellín, Corregimiento San Antonio de Prado, Vereda Astilleros, Divisória de águas de las quebradas Doña Maria y Ana Díaz, 2580–2650 m, 06°15′13″N, 75°40′10″W, 3 Dec 2005, *Rodríguez et al. 5648* (HUA). **Risaralda**: Santuario, PNN Tatamá, camino que lleva al páramo de Tatamá, subiendo hacia Morro Zancudo, 2723 m, 05°07′28″N, 76°02′30″W, 17 Apr 2007, *Sundue & Vasco 1240* (NY).

ECUADOR. **Zamora-Chinchipe**: Area of Estación Cientifica San Francisco, road Loja-Zamora, ca. 35 km from Loja, 2200 m, 03°58′S, 79°04′W, 23 Mar 2004, *Werner 857* (UC).

Moranopteris basiattenuata can be recognized by rhizome scales with entire margins, moderately to densely setose leaves, non-gibbous segments, usually furcate veins, and two hydathodes per segment. Another helpful distinguishing character is the 1-branched hairs. In general, this kind of hair has a branch that is at least twice as long as the main branch (Figs. 10A–G). *Moranopteris apheloleppis* resembles *M. basiattenuata* but differs in having gibbous segments and lacking 1-branched hairs.

Some unusual specimens of *Moranopteris basiattenuata* such as *Moran 5580* (NY) have somewhat gibbous segments as seen in some segments of the type of *Grammitis basiattenuatum* var. *valens*.

Stork 2336 (UC) cited by Smith (1995) in Flora Mesoamericana as *Micropolypodium setulosum* (Rosenst.) A. R. Sm. represents a small plant of *Moranopteris basiattenuata*. The main characters match those of *M. basiattenuata*: 1-branched hairs near and on the costa abaxially and rhizome scales with ± entire margins and small lateral projections. This specimen is similar to *Maxon 9955* (NY), from Jamaica.

4. ***Moranopteris blepharidea*** (Copel.) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium blepharideum* Copel., Univ. Calif. Publ. Bot. 19: 304, pl. 64. 1941. *Xiphopteris blepharidea* (Copel.) Copel., Amer. Fern J. 42: 99. 1952. *Micropolypodium blepharideum* (Copel.) A. R. Sm., Novon 2: 422. 1992. *Grammitis blepharidea* (Copel.) Stolze, Fieldiana, Bot., n.s., 32: 112. 1993. TYPE.—PERU. **Huánuco**: Churubamba, Crest of Santo Toribio, trail Puente Durand to Exito, 2000 m, Sep 1936, *Y. Mexia 8147a* (holotype: UC-595042; isotype: US-n.v.). **Figs. 3M, 7, 11.**

Polypodium buesii Maxon, Contr. Gray Herb. 165: 72. 1947. *Xiphopteris buesii* (Maxon) Copel., Amer. Fern J. 42: 105. 1952. *Grammitis buesii* (Maxon)

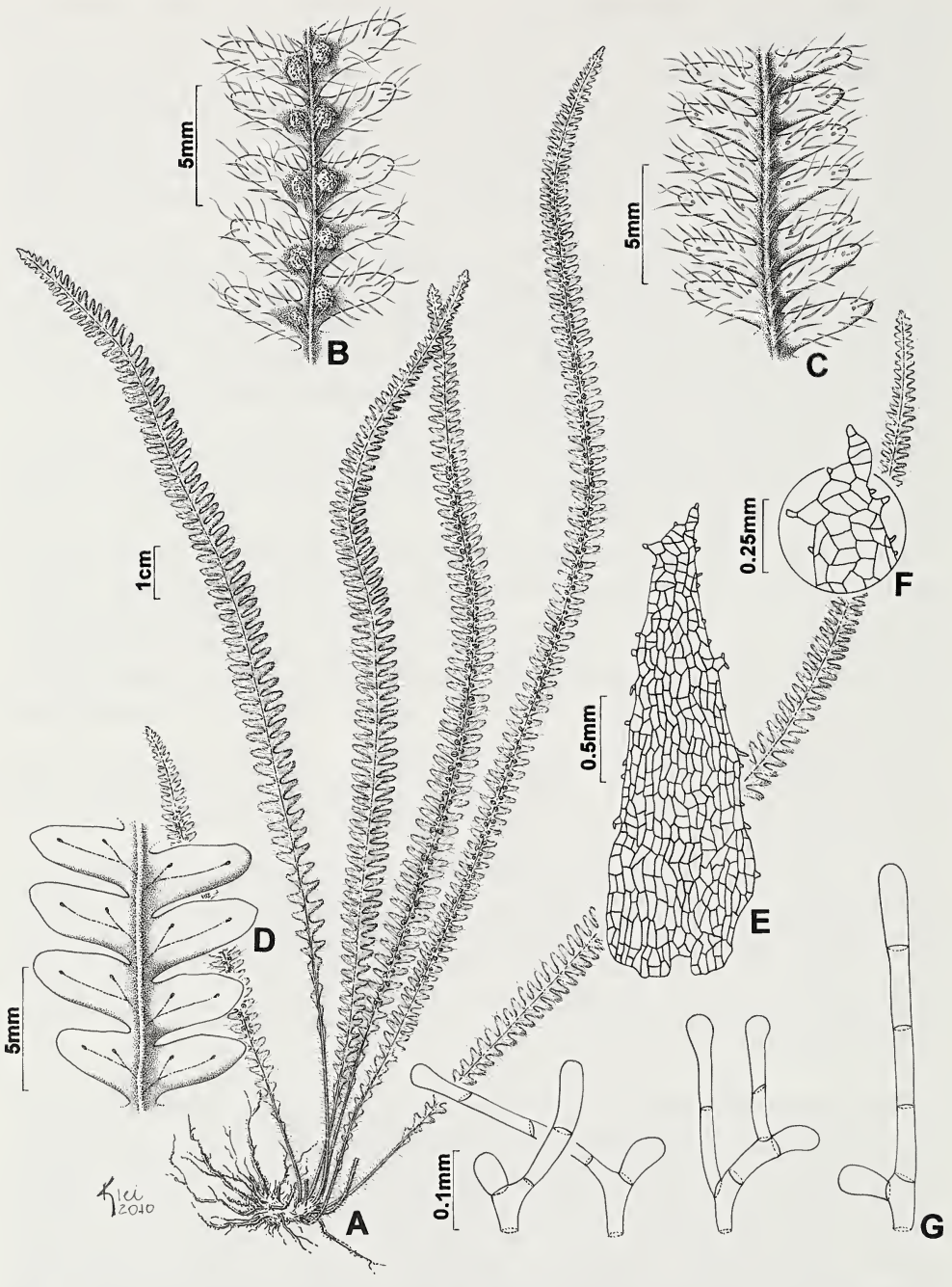

Fig. 11. *Moranopteris blepharidea*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Detail of apex of rhizome scale. G. Branched hairs (rehydrated) from costa. A–C, E–F: *Müller & Heirichs 6173* (LPB). D, G: *Kessler et al. 11973* (UPCB).

Lellinger, Amer. Fern J. 74: 58. 1984. LECTOTYPE (here designated).—PERU. **Cuzco:** Cerro Chuyapé, 24 Jun 1941, *C. Bües A45* p.p. (US-1858604, "as A").

Plants epiphytic. *Rhizomes* erect with scales 1.4–2.6 × 0.4–0.6 mm, these golden to yellow-brown, rarely castaneous, lanceolate to ovate-lanceolate, bases cordate, apices acute, usually with apical or subapical gland-like cells, margins entire, or with small lateral projections. *Leaves* erect to pendent, determinate, 7.5–22.5 cm × 4.0–11.5 mm, moderately setose; *stipes* (0.9–)1.2–4.0 cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, rarely pinnate at bases, gradually tapering proximally to a narrow wing, chartaceous or membranaceous; *costae* weakly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, (50–)60–80° to costae, 43–78 pairs, 0.3–0.9 mm apart, subopposite, not gibbous, symmetric, (2.5–)3.0–4.5 × (0.9–)1.5–1.9 mm, mostly deltate-lanceolate, rarely oblong, deltate toward laminar bases, decurrent, apices mostly acute, margins plane, sometimes slightly revolute, with hyaline cells inconspicuous or absent; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, elliptic; *setae* 0.6–2.2(–4.5) mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* scattered on stipes, costae, laminar tissue abaxially, and margins, hairs hyaline, slightly red-brown, 1- or 2-branched, the main branch 2- or 3-celled, 0.10–0.15 mm long, the 1-branched hairs with the branch more than twice as long as the main branch, 1st branch 2–4-(5-)celled, 0.20–0.50 mm long, 2nd branch, if present, 1–3-celled, 0.15–0.20 mm long. *Sori* one per segment, round, 1.3–1.6 mm diam.

Distribution.—Colombia, Peru, and Bolivia; 1700–3100 m.

Selected Specimens Examined.—COLOMBIA. **Huila**: Cordillera Oriental, 15 km SE of Garzón, 2225 m, 1 Feb 1945, *Little Jr. 9349* (US).

PERU. **Cuzco**: Calca, Road Quebrada-Alto Lacco, 2800 m, 12°37′22″S, 72°14′40″W, 30 Apr 2006, *van der Werff et al. 21206* (MO, NY). **Pasco**: Oxapampa, Parque Nacional Yanachaga Chemillén, parte alta del Refugio el Cedro, 2450–2680 m, 10°32′S, 75°21′W, 20 Mar 2003, *Monteagudo et al. 4737* (UC). **Puno**: Sandia, on the steep slopes east of Oconeque itself east 3 hours from Limbani, 2438–2743 m, 11 Oct 1943, *Hodge 6087* p.p. (US).

BOLIVIA. **Cochabamba**: Ayopaya, Comunidad Pampa Grande, antes de llegar al primer rio que atravieza la senda desde Tunki, 2030 m, 16°40′S, 66°28′W, 11 Sep 2002, *Jiménez & Moguel 1531* (GOET, UC). **La Paz**: Franz Tamayo, PN-ANMI Madidi, sendero Keara-Mojos, a media hora de caminata aproximadamente desde Tokuaqe por la senda al inciensal, 2420 m, 14°37′S, 68°57′W, 31 Oct 2001, *Jiménez & Gallegos 708* (GOET, UC); Nor Yungas, NW slope of Cerro Uchumani S Coroico, 2300 m, 16°12′S, 67°44′W, 17 Sep 1997, *Müller & Heinrichs 6173* (GOET, LPB); idem, 5 km de Chuspipata hacia Coroico, 2750 m, 16°23′S, 67°48′W, 18 Sep 1997, *Kessler et al. 11973* (GOET, LPB, UPCB).

Moranopteris blepharidea has rhizome scales with entire margins or with small lateral projections. The costae have mostly 1-branched hairs, these with the first branch at least twice as long as the main branch (Figs. 11E–G). It is similar to *M. hyalina*, which differs by the rhizome scales with long, hyaline setiform projections on the margins.

Some specimens of *Moranopteris blepharidea* have rhizome scales with a single hyaline setiform projection: *Werff et al. 21206* (NY), *Hodge 6087* (US), *Jiménez et al. 2965* (UC), *Kessler et al. 7169* (UC), *7174* (UC), and *Beck* 17493 (UC).

The type of *Polypodium buesii* is mixed with *Moranopteris hyalina*. The specimen with three or four hyaline setiform projections on the scale margins is *M. hyalina* (it was indicated as "B" at US-1858604) and those with entire margins or with only few small lateral projections are *M. blepharidea* (indicated as "A" at US-1858604). Tryon and Stolze (1993) subsumed *P. buesii* under *M. blepharidea*.

Moranopteris hyalina has rhizome scales with many to few hyaline setiform projections and some small lateral projections on the margins. Based on these characters, *M. blepharidea* and *M. hyalina* may overlap, morphologically, and they might represent the same species. More populational studies are necessary to resolve this question. If both are considered the same taxon, *M. hyalina* has priority.

5. ***Moranopteris caucana*** (Hieron.) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium caucanum* Hieron., Bot. Jahrb. Syst. 34: 503. 1904. *Xiphopteris caucana* (Hieron.) Copel., Amer. Fern J. 42: 98. 1952. *Grammitis caucana* (Hieron.) C. V. Morton, Contr. U.S. Natl. Herb. 38: 96. 1967. *Micropolypodium caucanum* (Hieron.) A. R. Sm., Novon 2: 422. 1992. LECTOTYPE (designated by Smith, 1995).—COLOMBIA. **Cauca**: Río Dagua, 2300 m, 20 Oct 1882, *F. C. Lehmann 3257* (frag. B-200149305; isolectotype: BM-n.v.). **Figs. 9B, 12.**

Plants epiphytic or terrestrial. *Rhizomes* erect with scales 1.0–1.8 × 0.2–0.5 mm, these castaneuos, lanceolate, bases truncate to cordate, apices acute, usually with apical or subapical gland-like cells, margins with long setiform projections, rarely setiform projections occurring on the scale surfaces on distal third, setiform projections red-brown, 0.1–0.4 mm long. *Leaves* erect to pendent, ± indeterminate, 8.0–30.0 cm × (2.5–)3.0–10.0 mm, moderately setose; *stipes* 0.7–4.0 cm long, yellow-brown to dark brown, wings absent; *laminae* linear, pinnatisect, rarely pinnate at bases, abruptly tapering proximally, chartaceous; *costae* mostly obscured by laminar tissue abaxially, or sometimes weakly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* patent to ascending, mostly 70–90° to costae, 48–69 pairs, 0.8–2.2 mm apart, subopposite, not gibbous, symmetric, (1.7–)2.8–5.0 × (0.9–)1.2–2.2 mm, mostly deltate, rarely oblong, sligthly decurrent, apices slightly rounded to acute, margins plane, with hyaline cells inconspicuous or absent; *veins* simple, obscure, 1(2) hydathode per segment, elliptic to linear; *setae* 1.5–2.2 mm long, dark red-brown, on all sides of stipes,

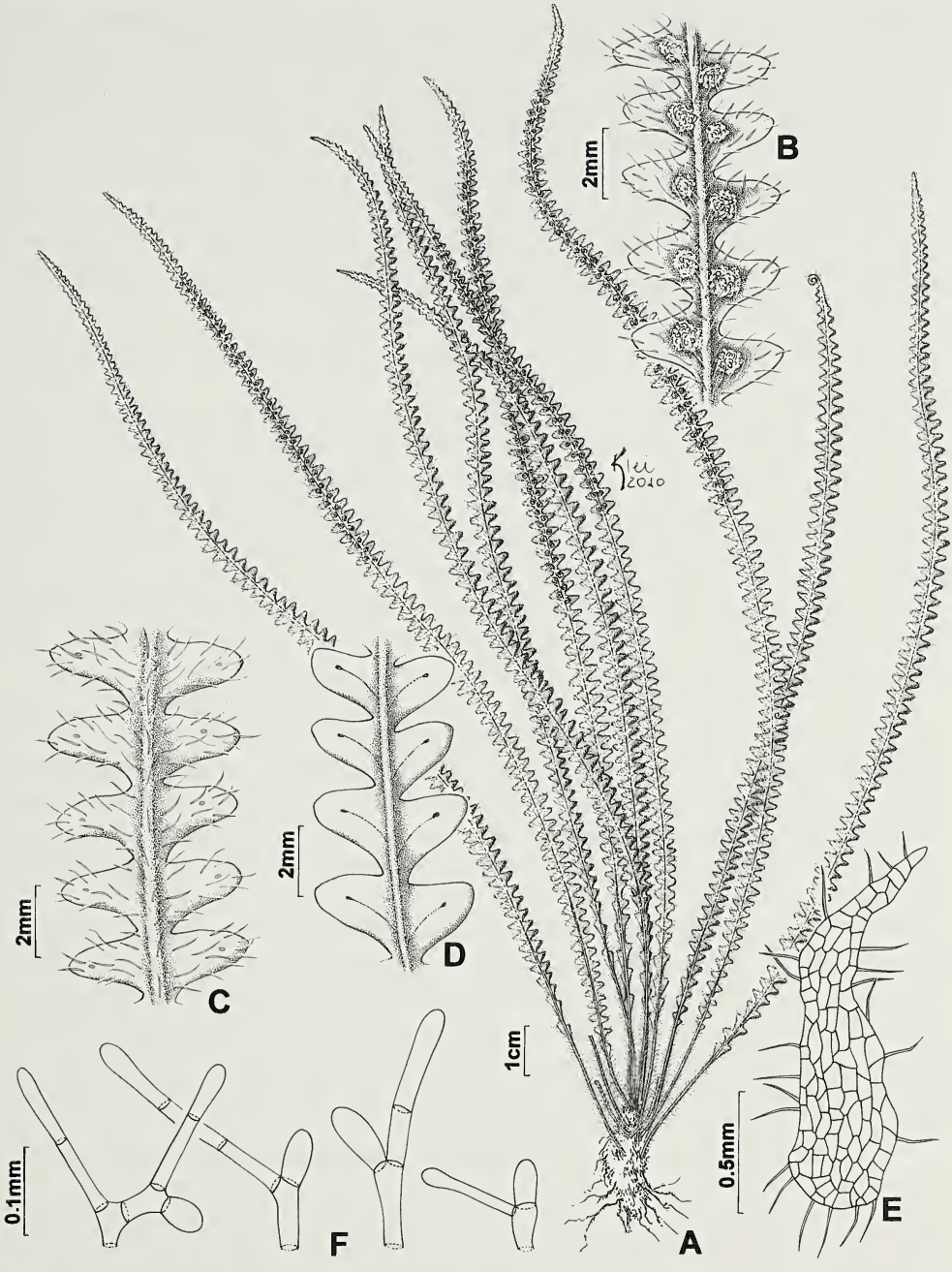

FIG. 12. *Moranopteris caucana*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Branched hairs (rehydrated) from costa. A–C, E: *Steyermark et al. 126043* (NY). D, F: *Steyermark 74948* (NY p.p.).

costae, and laminar tissue; *hairs* present on stipes, costae, and laminar tissue (mainly near costae abaxially), hyaline to yellowish, slightly red-brown, unbranched and branched, the unbranched hairs commonly 3-celled, ca. 0.15 mm long, mainly with branched hairs, mostly 1-branched, sometimes 2-branched, the main branch 2-(3-)celled, (0.05–)0.10–0.15 mm long, the 1-branched hairs with the first branch at least twice as long as the main branch, 1st branch (1-)2- or 3-celled, 0.15–0.25 mm long, 2nd branch, if present, 1- or 2-celled, 0.10–0.15 mm long. *Sori* one per segment, round, 1.1–1.7 mm diam.

Distribution.—Nicaragua, Costa Rica, Panama, Guyana, Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil; 1200–3550 m.

Selected Specimens Examined.—NICARAGUA. Without exact locality: 1853–1856, *Wright 15* (B).

COSTA RICA. **Cartago**: Along trail leading eastward into mountains from road into Tapanti Reserve ca. 1 km S of jct. of Quebrada Salto and Río Grande de Orosi, also known as "Quebrada Val Verde", 1500–1800 m, 09°43′N, 83°47′W, 1 Feb 1986, *Smith et al. 2156* (UC). **Heredia**: National Park Braulio Carrillo, transect trail between OTS-Station La Selva and Volcán Barva, 2000 m, 10 Mar 2003, *Kluge 5624* (GOET). **Limón**: Cantón de Limón, El Progresso, siguiendo la fila a Cerro Matama, Fila Matama, Valle de La Estrella, 1600 m, 09°47′20″N, 83°07′30″W, 23 Apr 1989, *Herrera & Chacón 2726* (UC). **Puntarenas**: Monteverde, 1550 m, 25 Nov 1979, *Koptur 241* (UC).

PANAMA. **Chiriquí**: Bugaba, Cerro Punta, along ridge to watershed to Bocas del Toro, along ridge to watershed to Bocas del Toro, 2200 m, 08°52′N, 82°33′W, 26 Jan 1985, *van der Werff & Herrera 6462* (NY, UC). **Chiriquí-Bocas del Toro**: Trail along continental divide to ca. 3 km E of Cerro Pate Macho, 2000–2200 m, 08°49′N, 82°23′W, 7 Feb 1986, *Smith et al. 2428* (UC).

GUYANA. **Cuyuni-Mazaruni**: Upper slope Roraima, 10 Dec 1884, *im Thurn 178* (US).

VENEZUELA. **Amazonas**: Atabapo, Cerro Marahuaca, cumbre, extremo noreste, 2580–2600 m, 03°50′N, 65°28′W, 30 Mar-1 Apr 1983, *Steyermark & Delascio 129279* (MO, NY, UC, VEN); Cerro Marahuaca-FHUIF, 2480–2500 m, 3°35′N, 65°20′W, 1–2 Feb 1982, *Steyermark et al. 126043* (NY). **Bolívar**: Gran Sabana, Ilu-tepui, 2300–2600 m, 17 Mar 1952, *Maguire 33476* (NY, UC, US); Chimantá Massif, northwestern part of summit of Abácapa-Tepuí, 2125–2300, 13 Apr 1953, *Steyermark 74948* p.p. (NY).

COLOMBIA. **Antioquia**: Ciudad Bolívar, Corregimiento San Bernardo de los Farallones, Farallones del Citará, sector La Peña, base del cerro Cabeza de Índio, 2750–3220 m, 05°46′19″N, 76°03′13″W, 10 Nov 2004, *Rodríguez et al. 4682* (HUA, NY). **Bolívar**: Below Páramo de Chaquiro, Cordillera Occidental, 2800–3100 m, 24 Feb 1918, *Pennell 4355* (NY). **Cauca**: Río Dagua, 2300 m, 20 Oct 1882, *Vasquez et al. 28455* (NY, UC). **Chocó**: San José del Palmar, Cerro del Torrá, vertiente oriental, 2500–2550 m, 14 Aug 1988, *Silverstone-Sopkin et al. 4375A* (UC). **Huila**: Cauca boundary, on and about the juncture of the ridge between the drainages of the Río Guachicas with the main divide of the Cordillera Oriental at the head of Río Villalobos, SW of Pitalito, 2300 m,

01°34′N, 76°16′W, 6 Feb 1943, *Fosberg 19940* (US). **Meta**: Cordillera Oriental, upper Río Manzanares Valley, 20 km southeast of Gutiérrez, 65 km south of Bogotá, 2710 m, 7 Aug 1944, *Grant 9879* (HUA). **Nariño**: Reserva Natural La Planada, 7 km above Chucunés (on road between Tuquerres and Ricaurte), along trail to Pialapí, past entrance to La Planada Field Station, 1500–2000 m, 01°06′N, 77°53′W, 10 Mar 1990, *Croat 71244* (MO). **Valle del Cauca**: El Cairo, Cerro del Inglés, Cordillera Occidental, Serranía de los Paraguas, a 1 hora en jeep de El Cairo, 2400–2425 m, 30 Dec 1986, *Silverstone-Sopkin 2791A* (UC).

ECUADOR. **Carchi**: Ridge to NE of Rafael Quindís mountain finca, 2000 m, 00°52′N, 78°08′W, 29 Nov 1987, *Hoover 2027* (MO). **Napo**: Along road Baeza-Tena, ca. 1200 m, 7 Mar 1994, *van der Werff et al. 13445* (MO, NY, UC).

PERU. **Pasco**: Oxapampa, road to Chacos, 2400–2700 m, 10°35′S, 75°06′W, 17 Jul 2003, *van der Werff et al. 18573* (MO, UC). **San Martín**: Amazonas, 1950 m, 05°41′S, 77°48′W, 4 Mar 2001, *van der Werff et al. 16713* (MO, UC). **Ucayali**: Coronel Portillo, Iparia, cabecera de la cuenca (oeste) del Río Ariapo, afluente del Río Ucayali, alturas del cerro Ariapo, Reserva Comunal el Sira, 9°28′49″S, 74°32′02″W, 2000–2050 m, 21 Dec 2009, *Graham 5807* (UC).

BOLIVIA. **Cochabamba**: José Carrasco Torrico, 123 km antigua carretera Cochabamba-Villa Tunari, 2100 m, 17°08′S, 65°37′W, 9 Jul 1996, *Kessler et al. 7143* (GOET, LPB, UC).

BRAZIL. **Amazonas**: Pico da Neblina, summit, 2438–2590 m, 3 Dec 1965, *Maguire et al. 60536* p.p. (UC).

Moranopteris caucana is characterized by ± indeterminate leaves, deltate, non-gibbous segments each with a simple vein, and usually one hydathode per segment (Figs. 12A–E). In addition, the best way to distinguish it is by its hairs. The most common hairs in *M. caucana* are 1-branched, with the first branch at least twice as long as the main branch (Fig. 12F). It sometimes resembles *M. taenifolia* when this species lacks conspicuous gibbous segments. *Moranopteris taenifolia*, in this case, differs by in having oblong segments, furcate veins on fertile segments, two hydathodes per segment, and mainly by the unbranched and branched hairs with a setiform branch.

Moranopteris cookii can be confused with *M. caucana*. Both species have only simple veins, one hydathode per segment, and have the same kind of 1-branched hairs. *Moranopteris cookii* differs by rhizome scales with entire margins or with few short setiform projections (vs. conspicuous long setiform projections in *M. caucana*) and shape of the segments (oblong vs. deltate, respectively).

6. *Moranopteris cookii* (Underw. & Maxon) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium cookii* Underw. & Maxon, Contr. U.S. Natl. Herb. 17: 408. 1914. *Xiphopteris cookii* (Underw. & Maxon) Copel., Amer. Fern J. 42: 98. 1952. *Grammitis cookii* (Underw. & Maxon) F. Seym., Phytologia 31: 173. 1975. *Micropolypodium cookii* (Underw. & Maxon) A. R. Sm., Novon 2: 422. 1992. TYPE.—GUATEMALA. **Alta Verapaz**: near Finca Sepacuité, 20 Mar 1902, *O. F. Cook & R. F. Griggs 80* (holotype: US-407781; isotypes: NY-144945; frag. NY-144944). **Figs. 3A, B, E, G, 7B, 13.**

Polypodium basale Maxon, Amer. Fern J. 52: 110. 1952. *Grammitis basalis* (Maxon) Lellinger, Amer. Fern J. 74: 58. 1984. TYPE.—ECUADOR. **Napo-Pastaza**: near Puyo, 400 m, 18 Feb 1935, *Y. Mexia 6930* (holotype: US-1691351).

Plants epiphytic. *Rhizomes* erect with scales 1.2–1.7 × 0.3–0.6 mm, these yellow-brown to castaneous, ovate to ovate-lanceolate, bases slightly cordate, apices acute, usually with apical or subapical gland-like cells, margins entire, rarely with small lateral projections or short setiform projections, these rarely on the surface on distal third, setiform projections if present, red-brown, ca. 0.75 mm long. *Leaves* erect to arcuate, determinate, (3.5–)6.0–16.0 cm × 4.0–8.0 mm, moderately setose; *stipes* 0.3–1.5 cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costae* obscured by laminar tissue, or sometimes weakly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* patent, 80–90° to costae, 27–45 pairs, 0.5–1.0 mm apart, subopposite, not gibbous, symmetric, 2.2–4.6 × 1.2–2.2 mm, oblong, decurrent, apices rounded, margins slightly revolute, without hyaline cells; *veins* simple, obscure, 1 hydathode per segment, elliptic to obovate; *setae* 0.8–2.3 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on costae, and laminar tissue (mainly near costae abaxially), sometimes on the margins, hyaline, slightly red-brown, 1- or 2-branched, the main branch 2-(3-)celled, 0.1–0.15(–0.2) mm long, 1-branched hairs with the first branch at least twice as long as the main branch, 1st branch (1–)3- or 4-celled, (0.10–)0.15–0.2(–0.3) mm long, 2nd branch, if present, 2- or 3-celled, 0.10–0.15 mm long. *Sori* one per segment, round, 1.8–2.2 mm diam.

Distribution.—Guatemala, Costa Rica, Panama, and Ecuador; (400–)800–1300 m.

Selected Specimens Examined.—COSTA RICA. **Alajuela**: 11 km N of San Ramón, 1000 m, 28 Jul 1967, *Mickel 2929* p.p. (LP, NY). **Cartago**: P. N. Tapantí, Carretera ICE, Sendero Arboles Caidos, 1296 m, 09°44′58″N, 83°46′53″W, 4 Feb 2008, *Sundue et al. 1764* (NY, SP).

PANAMA. **Coclé**: El Valle, 800–1000 m, 28 Jun 1967, *Duke 13219* (NY).

ECUADOR. **Pastaza**: Mera Canton, 2 km northwest of Mera, at Campamento Vacacional Evangelico Mangayacu, 1250 m, 01°26′S, 78°07′W, 25 Jul 1992, *Fay & Fay 3765* (MO, UC).

Moranopteris cookii can be distinguished from other species by the simple veins, one hydathode per segment, patent and non-gibbous segments, also by 1-branched hairs, with the first branch at least twice as long as the main branch (Figs. 13A–F).

The margins of the rhizome scales in *Moranopteris cookii* are variable. *Fay & Fay 3733*, *3765* (MO) have entire margins; however their duplicates at UC have few short setiform projections or entire margins, sometimes on the same rhizome. *Moranopteris basiattenuata* is also similar but differs by the ascending segments, furcate veins in the fertile segments, and two hydathodes per segment.

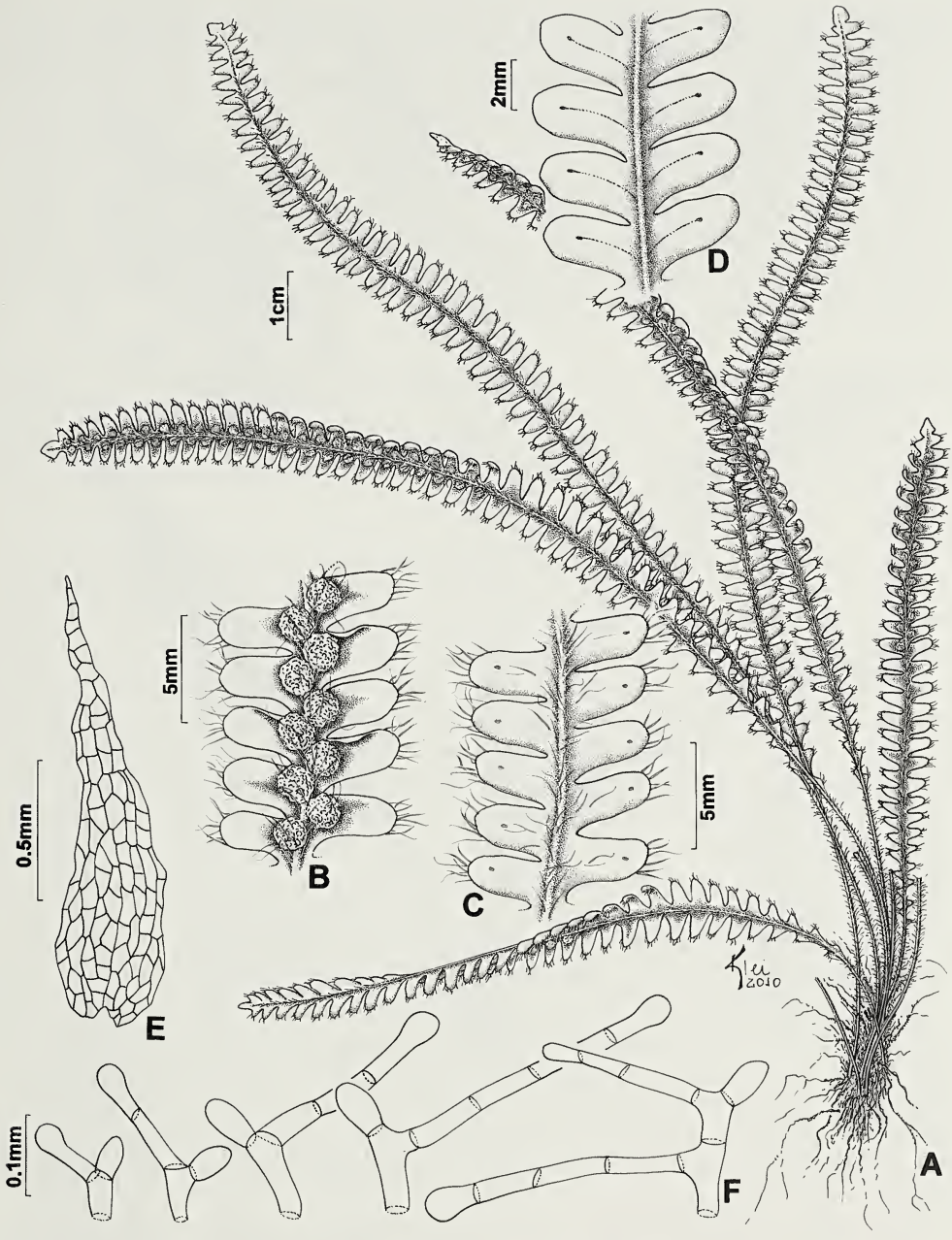

FIG. 13. *Moranopteris cookii*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Branched hairs (rehydrated) from costa. A–F: *Sundue et al. 1764* (NY).

7. ***Moranopteris gradata*** (Baker) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium gradatum* Baker, Fl. Bras. 1(2): 513. 1870. *Polypodium hirsutulum* Fée, Crypt. vasc. Br. 1: 87. 1869, *nom. illeg.*, *non* Forst (1786). *Ctenopteris gradata* (Baker) Copel., Philipp. J. Sci. 84: 437. 1955. *Grammitis gradata* (Baker) R. M. Tryon & A. F. Tryon, Rhodora 84: 128. 1982. *Terpsichore gradata* (Baker) A. R. Sm., Novon 3: 486. 1993. *Micropolypodium gradatum* (Baker) Labiak & F. B. Matos, Brittonia 59: 184. 2007. LECTOTYPE (here designated).—BRAZIL. **Rio de Janeiro**: "Habitat prope Rio de Janeiro", s.d., *A. Glaziou 2460* (P-637594; isolectotypes: P-632686 p.p.; BM-n.v.). **Figs. 3C, 5C, 14, 15A.**

Polypodium schwackei Christ in Schwacke, Pl. Nov. Mineiras 2: 20. 1900. *Ctenopteris schwackei* (Christ) Copel., Philipp. J. Sci. 84: 438. 1956. LECTOTYPE (here designated).—BRAZIL. **Minas Gerais**: "Habitat Serra de Ouro Preto", s.d., *C. A. W. Schwacke 9488* (P-632905; isolectotype: RB-36611).

Plants epiphytic, epipetric, or rarely terrestrial. *Rhizomes* short-creeping with scales 1.8–4.5 × 0.3–0.5 mm, these golden, yellow-brown or castaneous, linear to linear-lanceolate, bases cordate, apices acute, margins entire, or with small lateral projections. *Leaves* erect to pendent, determinate, 2.7–20.5 cm × 4.5–24.0 mm, sparsely to moderately setose; *stipes* 0.3–5.0 cm long, dark brown, narrowly winged; *laminae* elliptic, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costae* obscured by laminar tissue, or sometimes weakly visible with dark sclerenchyma abaxially, visible with dark sclerenchyma adaxially; *segments* ascending, 40–75° to costae, 11–30 pairs, 1.4–1.5 mm apart, subopposite, not gibbous, symmetric, 2.0–13.0 × 1.7–5.0 mm, deltate to deltate-lanceolate, entire, decurrent, apices rounded, margins sligthly revolute, without hyaline cells; *veins* pinnate, obscure or inconspicuous, > 2 hydathodes per segment, elliptic or obovate; *setae* 0.6–2.2 mm long, dark red-brown, rarely hyaline to yellowish (at the base of laminae and stipes), on all sides of stipes, costae, and laminar tissue; *hairs* present on stipes, costae, veins, and laminar tissue (mainly near costae abaxially), sometimes on the margins, hyaline, slightly red-brown, 1- or 2-branched, the main branch 2- or 3-celled, 0.1–0.2 mm long, sometimes the 1-branched hairs with the first branch at least twice as long as the main branch, 1st branch 1–3-celled, (0.05–)0.1–0.25 mm long, 2nd branch, if present, 1- or 2-celled, (0.05–)0.1(–0.15) mm long. *Sori* > 2 per segment, round, 1.0–1.7 mm diam.

Distribution.—Endemic to coastal Brazil (Espírito Santo, Minas Gerais, Paraná, Rio de Janeiro, Santa Catarina, and São Paulo States); 500–2500 m.

Selected Specimens Examined.—BRAZIL. **Espírito Santo:** Castelo, Braço do Sul, 6 Aug 1948, *Brade 19156* (NY, RB). **Minas Gerais**: Catas Altas, RPPN do Caraça, trilha para a Gruta do Pe. Caio, 1500 m, 20°05′28″S, 43°29′08″W, 1 Jun 2008, *Hirai et al. 564* (SP, VT); Ouro Preto, São Sebastião, Camarinhas, 1370 m, 20°22′12″S, 43°30′28″W, 27 May 2008, *Hirai et al. 526* (SP, TAIF, UC). **Paraná**:

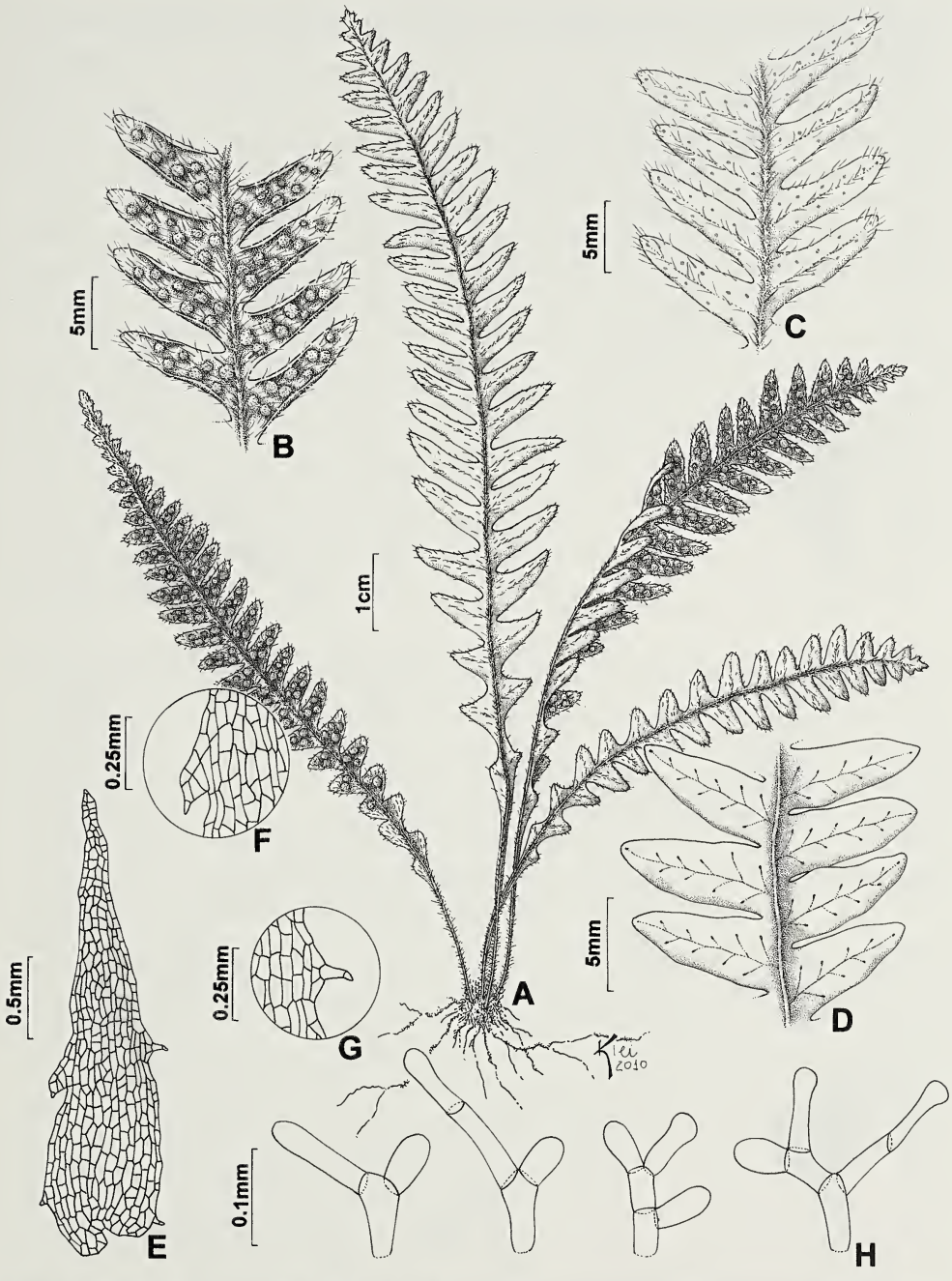

FIG. 14. *Moranopteris gradata*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F, G. Margins of rhizome scale. H. Branched hairs (rehydrated) from costa. A–H: *Hirai et al. 564* (SP).

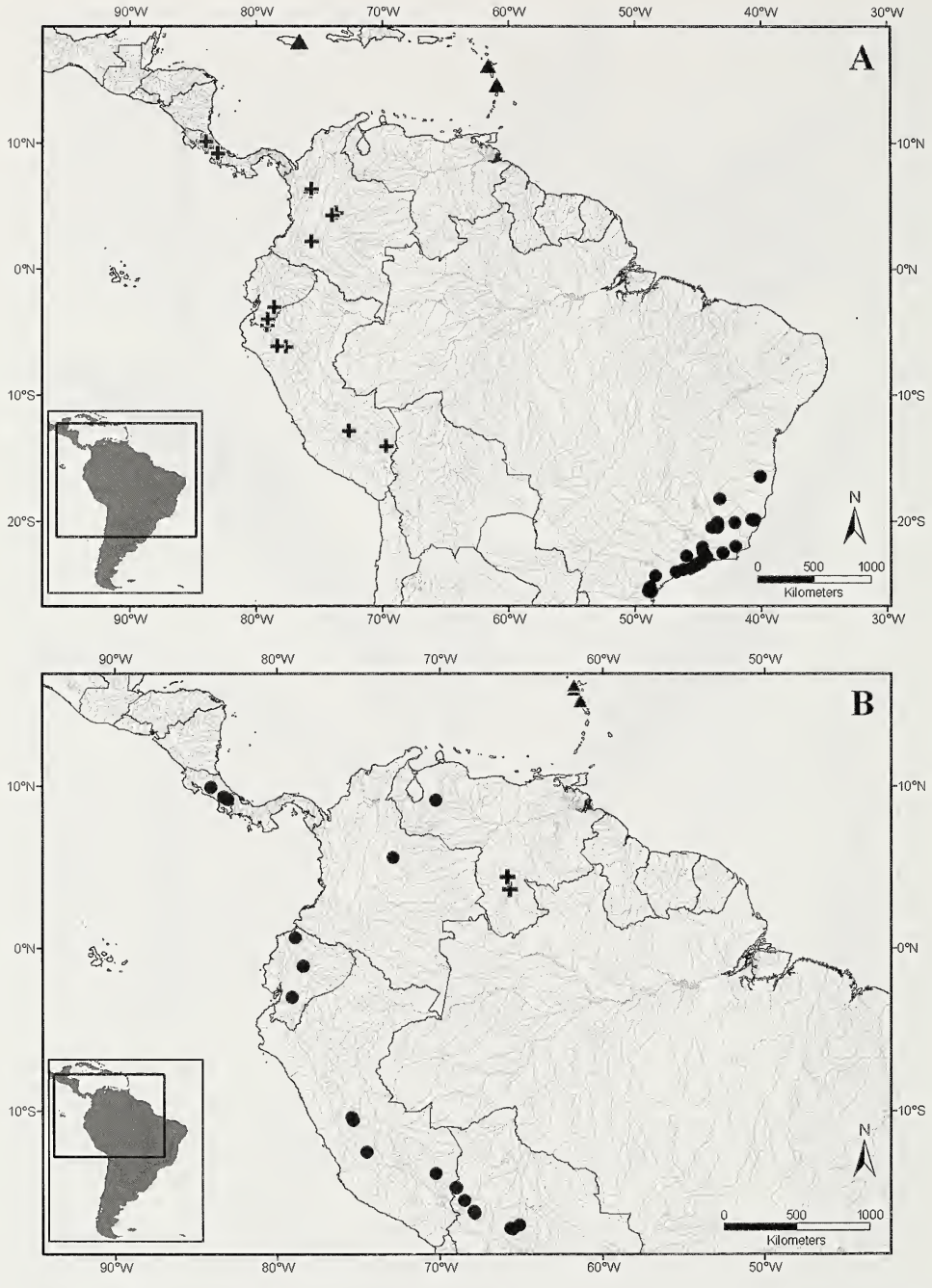

FIG. 15. A. Distribution of *Moranopteris gradata* (●), *M. grisebachii* (▲), *M. hyalina* (+). B. Distribution of *M. knowltoniorum* (▲), *M. liesneri* (+), and *M. longisetosa* (●).

Campina Grande do Sul, Serra do Capivari, próximo a Estação da Embratel, 1400 m, 25°08′S, 48°49′W, 26 Dec 2008, *Hirai & Schwartsburd 613* (SP). **Rio de Janeiro**: Santa Maria Madalena, Alto do Desengano, 2000 m, 3 Mar 1934, *Santos Lima & Brade 13169* (NY, RB). **Santa Catarina**: Joinville, Morro da Tromba, 500–600 m, 15 Sep 1901, *Schmalz 112* (NY). **São Paulo**: Campos do Jordão, Estrada para Pindamonhangaba, 1900 m, 28 Jun 1998, *Labiak 670* (SP).

Moranopteris gradata is easily recognized as being the only species of *Moranopteris* with pinnatisect laminae with undivided segments and pinnate veins (Figs. 14A–D). Furthermore, it has more than two hydathodes and more than two sori per segment (Figs. 14B, C).

The most closely related species are *Moranopteris achilleifolia* and *M. longisetosa*, which have been considered as belonging to the *Terpichore achilleifolia* group by Smith (1993). According to Smith, this group is characterized by having rhizomes that are generally slightly dorsiventral, orangish to orange-brown rhizome scales, entire to glandular to sparingly setose margins, arching leaves, distinct stipes, determinate blades, no black clavate fungal fruiting bodies, pinnae not reduced at the base of the leaves, laminae with solitary setae, hydathodes lacking calcareous secretions and glabrous sporangia.

8. *Moranopteris grisebachii* (Underw. ex C. Chr.) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium grisebachii* Underw. ex C. Chr., Index Filic. 531. 1906, based on *P. exiguum* Griseb., *non* Heward (1838). *Polypodium exiguum* Griseb, Fl. Br. W. Ind. 701. 1864, *nom. illeg.*, *non* Heward (1838). *Xiphopteris grisebachii* (Underw. ex C. Chr.) Copel., Amer. Fern J. 42: 95. 1952. *Grammitis grisebachii* (Underw. ex C. Chr.) Proctor, Bull. Inst. Jamaica, Sci. Ser. 5: 33. t. 2(7–8). 1953. *Micropolypodium grisebachii* (Underw. ex C. Chr.) A. R. Sm., Novon 2: 422. 1992. TYPE.—JAMAICA. Summit of the Blue Mountain Peak, s.d., *W. Purdie s.n.* p.p. (holotype: K-575413). **Figs. 15A, 16.**

Plants epiphytic. *Roots* proliferous. *Rhizomes* erect with scales 0.4–1.2 × 0.15–0.25 mm, these golden to yellow-brown, ovate to lanceolate, bases sligthly cordate, apices acute to apiculate, sometimes with an apical cillium-like cell, margins entire. *Leaves* erect to arcuate, determinate, 2.0–6.0 cm × 2.0–4.0 mm, not setose; *stipes* 0.2–0.8 cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, membranaceous; *costae* visible with dark sclerenchyma abaxially, obscured by laminar tissue and weakly visible with dark sclerenchyma at bases adaxially; *segments* ascending, 30–40° to costae, 7–21 pairs, 0.6–2.0 mm apart, alternate, gibbous, asymmetric, 1.4–2.4 × 1.0–1.4 mm, deltate to ovate-oblong, decurrent, apices rounded, sometimes subacute, margins plane, sometimes the acroscopic margin folded and with hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, mostly visible at bases with dark sclerenchyma abaxially, weakly obscured by laminar tissue adaxially, (1)2 hydathodes per segment, elliptic to linear; *setae* absent; *hairs* scattered on costae, laminar tissue abaxially, and

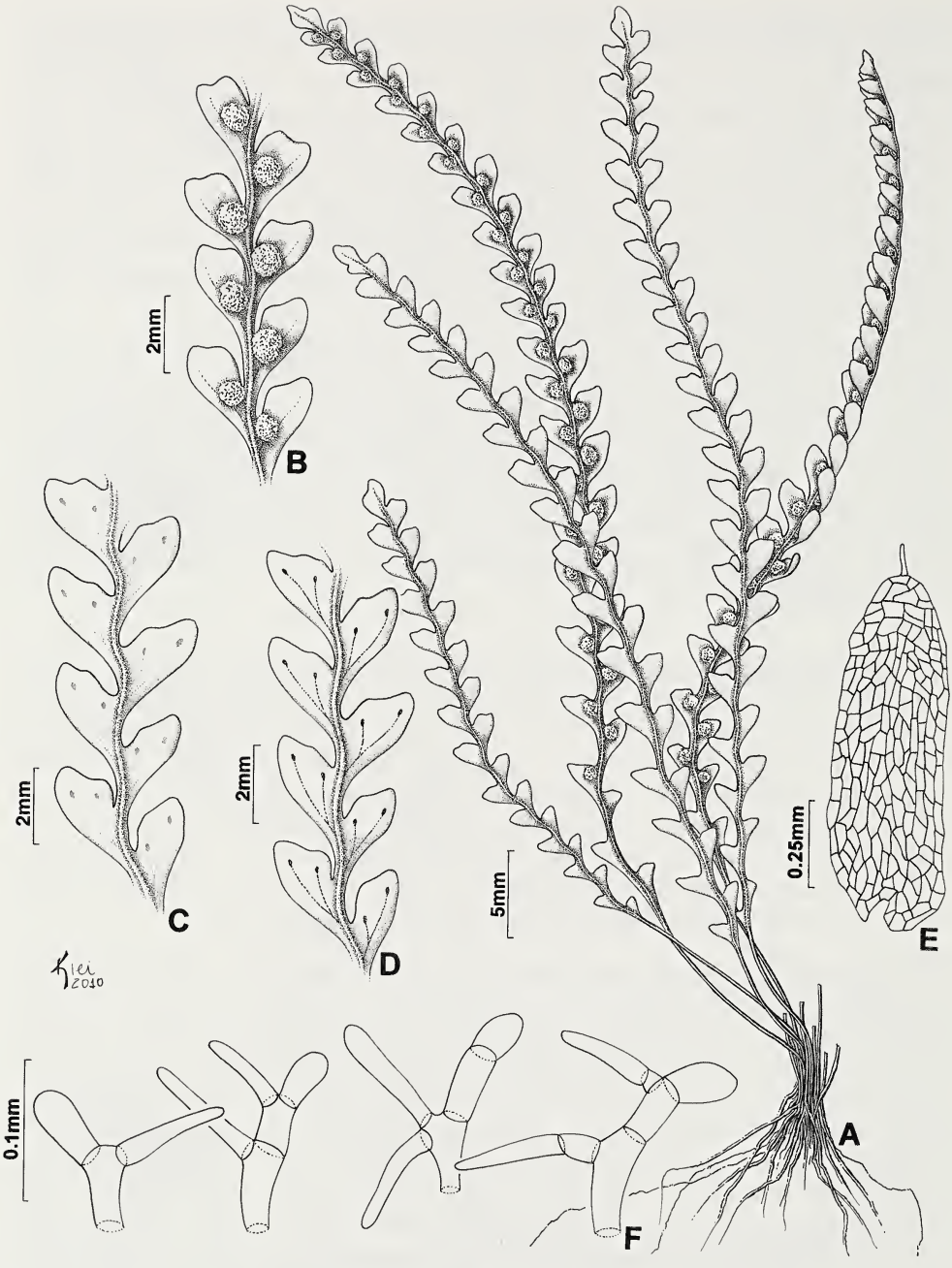

Fig. 16. *Moranopteris grisebachii*. A. Habit. B. Fertile segments showing sori, abaxial view. C. Segments showing hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Branched hairs (rehydrated) from costa. A–C: *Jenman s.n.* (NY). D–F: *Underwood 3174* (NY).

margins, hyaline, 1- or 2-branched, sometimes branches sligthly acicular, the main branch 2- or 3-celled, (0.05–)0.1–0.15 mm long, 1st branch 1- or 2-celled, (0.05–)0.1 mm long, 2nd branch, if present, 1- or 2-celled, < 0.1 mm long. *Sori* one per segment, round, 0.7–1.1 mm diam.

Distribution.—Endemic to the Greater Antilles (Jamaica) and the Lesser Antilles (Guadeloupe and Martinique); (650–)1700–2300 m.

Selected Specimens Examined.—JAMAICA. **Portland**: Blue Mountain Peak, 2261 m, 30 Apr 1898, *Harris 7143* (NY); Idem, 2232 m, 11–12 Feb 1903, *Underwood 1472* (NY); Cinchona, Sir John Peak, 2–10 Sep 1906, *Underwood 3174* (NY); Steep forest slope between eastern Blue Mountain Peak and Sugarloaf, 2000–2200 m, 8 Jul 1926, *Maxon 9961* (NY); Summit of Blue Mountain Peak, 2100–2200 m, 7–9 Jul 1926, *Maxon 9869* (NY); Trail to Sir Johns Peak, 7 Jun 1910, *H.H.Y. 271* (PH).

GUADELOUPE. 1895, *Duss 4087* (B).

MARTINIQUE. 650–900 m, Sep 1883, *Duss 1655* p.p. (B, NY).

Moranopteris grisebachii is readily recognized by rhizome scales with entire margins, furcate veins mostly visible at segment bases, with dark sclerenchyma abaxially, two hydathodes per segment, and hyaline margins on the segments (Figs. 16B, C, E). It also has proliferous roots, a feature not observed in other species of *Moranopteris*.

The most similar species is *Moranopteris perpusilla*, a Brazilian endemic that differs in having chartaceous laminae, non-gibbous segments, and veins obscured by laminar tissue abaxially (Figs. 27B, C).

Moranopteris grisebachii resembles *Lellingeria ruglessii* Proctor (=*Stenogrammitis ruglesii* (Proctor) Labiak), an endemic species from Jamaica (see details in Proctor, 1985).

Moranopteris grisebachii sometimes has segments acroscopically with a small fold, which partially covers the sorus: *Underwood 1472* (NY) and *Maxon 9869* (NY). Additionally, its branched hairs are sometimes slightly acicular.

9. *Moranopteris hyalina* (Maxon) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium hyalinum* Maxon, Contr. U.S. Natl. Herb. 17: 406. 1914. *Xiphopteris hyalina* (Maxon) Copel., Amer. Fern J. 42: 107. 1952. *Grammitis hyalina* (Maxon) F. Seym., Phytologia 31: 174. 1975. *Micropolypodium hyalinum* (Maxon) A. R. Sm., Novon 2: 422. 1992. TYPE.—COSTA RICA. Volcán de Barba, 6 Fev 1890, *H. Pittier 1928* (holotype: US-833632; isotypes: P-696178; frag. NY-144964). **Figs. 15A, 17.**

Plants epiphytic, rarely epipetric. *Rhizomes* erect with scales 1.1–3.5 × 0.2–0.6 mm, these golden to yellow-brown, rarely castaneous, lanceolate to linear, rarely ovate-lanceolate, bases cordate to subcordate, apices attenuate to acute, usually with apical or subapical gland-like cells, margins with many to few long setiform projections, hyaline to yellowish, 0.1–0.2 mm long, also with small lateral projections, these occurring on the margins and scale surfaces. *Leaves* erect to arcuate, determinate, 7.0–24.5 cm × 5.0–11.5 mm, moderately

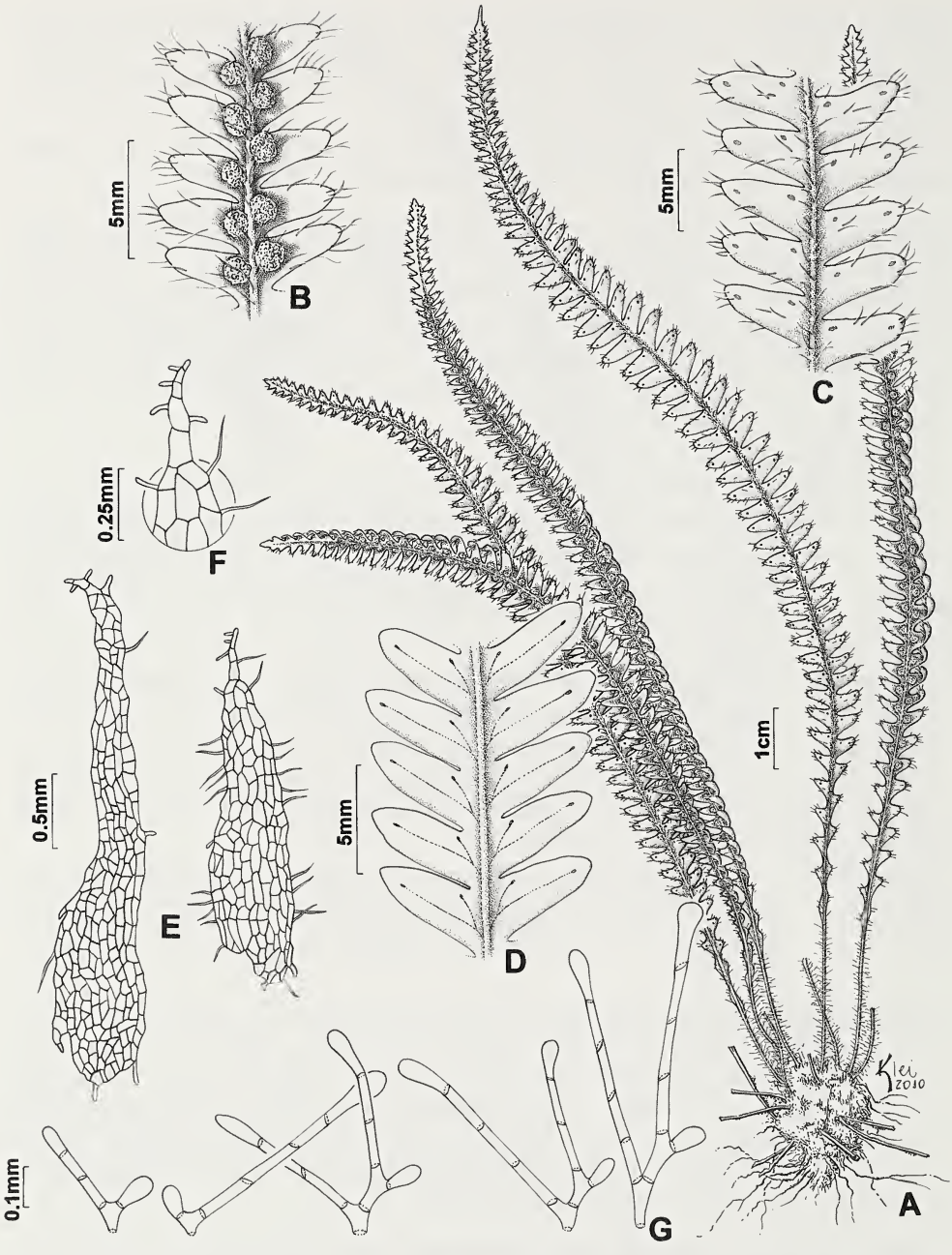

Fig. 17. *Moranopteris hyalina*. A. Habit. B. Detail of fertile segments showing sori and setae, abaxial view. C. Detail of segments showing setae and hydathodes, adaxial view. D. Detail of venation (cleared lamina). E. Rhizome scales. F. Detail of apex of rhizome scale. G. Branched hairs (rehydrated) from costa. A–G: *Rojas 3528* p.p. (NY).

setose; *stipes* 1.0–4.0 cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costae* weakly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, (50–)60–80° to costae, 25–62 pairs, 0.3–1.3 mm apart, subopposite, not gibbous to slightly gibbous, symmetric, 3.6–6.0 × 1.5–3.0 mm, oblong to oblong-lanceolate, deltate toward laminar bases, decurrent, apices slightly rounded to acute, margins plane, sometimes slightly revolute, without hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, elliptic, rarely obovate-linear; *setae* 1.2–3.2 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* scattered on stipes, costae, laminar tissue abaxially, and margins, hyaline, slightly red-brown, 1- or 2-branched, the main branch 2- or 3-celled, 0.1–0.3 mm long, the 1-branched hairs with the branch more than twice as long as the main branch, 1st branch 3–5-celled, 0.25–0.65 mm long, 2nd branch, if present, 2–4-celled, 0.15–0.55 mm long. *Sori* one per segment, round, 1.0–1.8 mm diam.

Distribution.—Costa Rica, Colombia, Ecuador, and Peru; 2100–3050 m.

Selected Specimens Examined.—COSTA RICA. **Alajuela**: Volcán Poás, Poas Lake region, 2590 m, 6 Jun 1928, *Stork 2350* (UC). **Cartago**: Along Pan-American Hwy, Km 67, 14 Jan 1999, *Smith 2583* (UC). **Heredia**: P. N. Braulio Carrillo, transect trail between OTS-Station La Selva and Volcán Barva, 2700 m, 28 Apr 2003, *Kluge 6235* (GOET); Cantón de Barva, P. N. Braulio Carrillo, Cuenca del Tárcoles, Estación Barva entre la Estación y Laguna del Barva, 2700–2900 m, 10°07′20″N, 84°06′00″W, 30 May 1997, *Rojas 3528* p.p. (NY). **Puntarenas**: Cantón de Buenos Aires, P. N. La Amistad, Tararia, Limón-Puntarenas, Parque International La Amistad, Sendero a Cerro Kámuk, entre Cerro Kas, 2900–3050 m, 09°12′00″N, 83°03′30″W, 8 Nov 1996, *Rojas 3210* (UC). **San José**: Cerro de la Muerte, Madre Selva, Südseite der Carretera Interamericana etwa 100 m vor Km 66, ca. 3 km östlich Trinidad, 2560 m, 18 May 1990, *Döbbeler 189B* (M).

COLOMBIA. **Antioquia**: Bello, Corregimiento de San Félix, Alto de Las Baldias, sector Antenas de el Colombiano, 2950–3050 m, 06°20′38″N, 75°38′54″W, 1 Oct 2005, *Rodríguez et al. 5496* (HUA). **Cundinamarca**: Cordillera Oriental, north side of Quebrada San Roque, Río Blanco Valley, 10 km west of Gutiérrez, 45 km S of Bogotá, Station 42, 2725 m, 27 Jul 1944, *Grant 9702* (US). **Huila**: Cordillera Oriental, 15 km SE of Garzón, 2346 m, 1 Feb 1945, *Little Jr. 9354a* (US). **Meta**: San Juanito, PNN Chingaza, cañón del Río Guácharo, Cordillera Oriental, 2767 m, 04°29′27″N, 73°40′58″W, 3 May 2007, *Sundue & Vasco 1305* (NY).

ECUADOR. **Morona-Santiago**: Vía Plan de Milagro-Gualaceo, cerca a Tinajillas, 2100–2200 m, 03°02′S, 78°33′W, 6 Fev 1989, *Palacios & van der Werff 3755* (MO). **Zamora-Chinchipe**: Reserva Tapichalaca, nearby Ventanilla, 2600 m, 04°29′S, 79°07′W, 26 Oct 2003, *Lehnert 977* (GOET, UC).

PERU. **Amazonas**: Chachapoyas, scrub forest along Río Ventilla 1–2 km, west of Molinopampa, 2350–2400 m, 23–25 Jul 1962, *Wurdack 1511* (NY, P, S,

UC, US). **Cuzco**: Cerro Chuyapi, 2400 m, 20 Jun 1941, *Bües A38* (US). **Puno:** Sandia, on steep slopes east of Oconeque itself east 3 hours from Limbani, 2438–2743 m, 11 Oct 1943, *Hodge 6087* p.p. (US).

Generally *Moranopteris hyalina* is easier to recognize than other species. A good distinguishing character is its rhizome scales with long, hyaline, setiform projections on the margins. Maxon (1914) used this character to choose the epithet for this species (Fig. 17E).

Moranopteris hyalina can be confused with *M. blepharidea* based on the general aspect of the leaves and the 1-branched hairs; see comments under that species for comparison.

10. *Moranopteris killipii* (Copel.) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Xiphopteris killipii* Copel., Amer. Fern J. 42: 105. t. 10. 1952. *Grammitis killipii* (Copel.) Lellinger, Amer. Fern J. 74: 58. 1984. TYPE.—COLOMBIA. **El Valle**: San Antonio, west of Cali, near summit of Cordillera Occidental, 26 Feb–2 Mar 1939, *E. P. Killip & H. Garcia 33887* (holotype: US-1772517). **Figs. 3J, 18, 23A.**

Plants epiphytic. *Rhizomes* erect with scales 0.9–1.1 × 0.20–0.35 mm, these castaneous, ovate-lanceolate, bases slightly cordate, apices acute, usually with apical or subapical gland-like cells, margins with short setiform projections and glanduliform projections, these sligthly red-brown. *Leaves* pendent, ± indeterminate, 10–26(–70) cm × 5.5–7.0 mm, moderately setose; *stipes* 1.0–2.7 cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, rarely pinnate at bases, gradually tapering proximally to a narrow wing, membranaceous; *costae* visible with dark sclerenchyma abaxially, weakly visible with dark sclerenchyma adaxially; *segments* ascending, mostly 70–80° to costae, 23–73 pairs, 0.1–2.2 mm apart, subopposite, slightly gibbous to gibbous, asymmetric, 2.1–3.6 × 1.5–2.6 mm, ovate to slightly oblong, slightly deltate toward laminar bases, decurrent, apices rounded, margins plane and with hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, elliptic, obovate, sometimes round; *setae* 1.3–3.5 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* scattered on stipes, costae, laminar tissue abaxially, and margins, hairs hyaline, slightly red-brown, 1- or 2-branched, the main branch 2-(3-)celled, 0.10–0.15 mm long, 1-branched hairs with the branch more than twice as long as the main branch, 1st branch (1-)2- or 3-celled, 0.1–0.3 mm long, 2nd branch, if present, 1- or 2-celled, (0.05–)0.1–0.2 mm long. *Sori* one per segment, round, 1.2–1.4 mm diam.

Distribution.—Endemic to Andes, Colombia and Ecuador; 1000–2350 m.

Specimens Examined.—COLOMBIA. **Nariño**: Reserva Natural La Planada Sendero "La Vieja" and "La Piña" NW of the science center, 1850 m, 01°09′37″N, 77°59′13″W, 19 Jul 1996, *Bittner 2670* (UC).

ECUADOR. **Zamora-Loja**: 1000–1500 m, s.d., *Lehmann 7655* (K).

Moranopteris killipii is known from only a few collections from the Andes of Colombia and Ecuador. It is characterized by pendent leaves, with ±

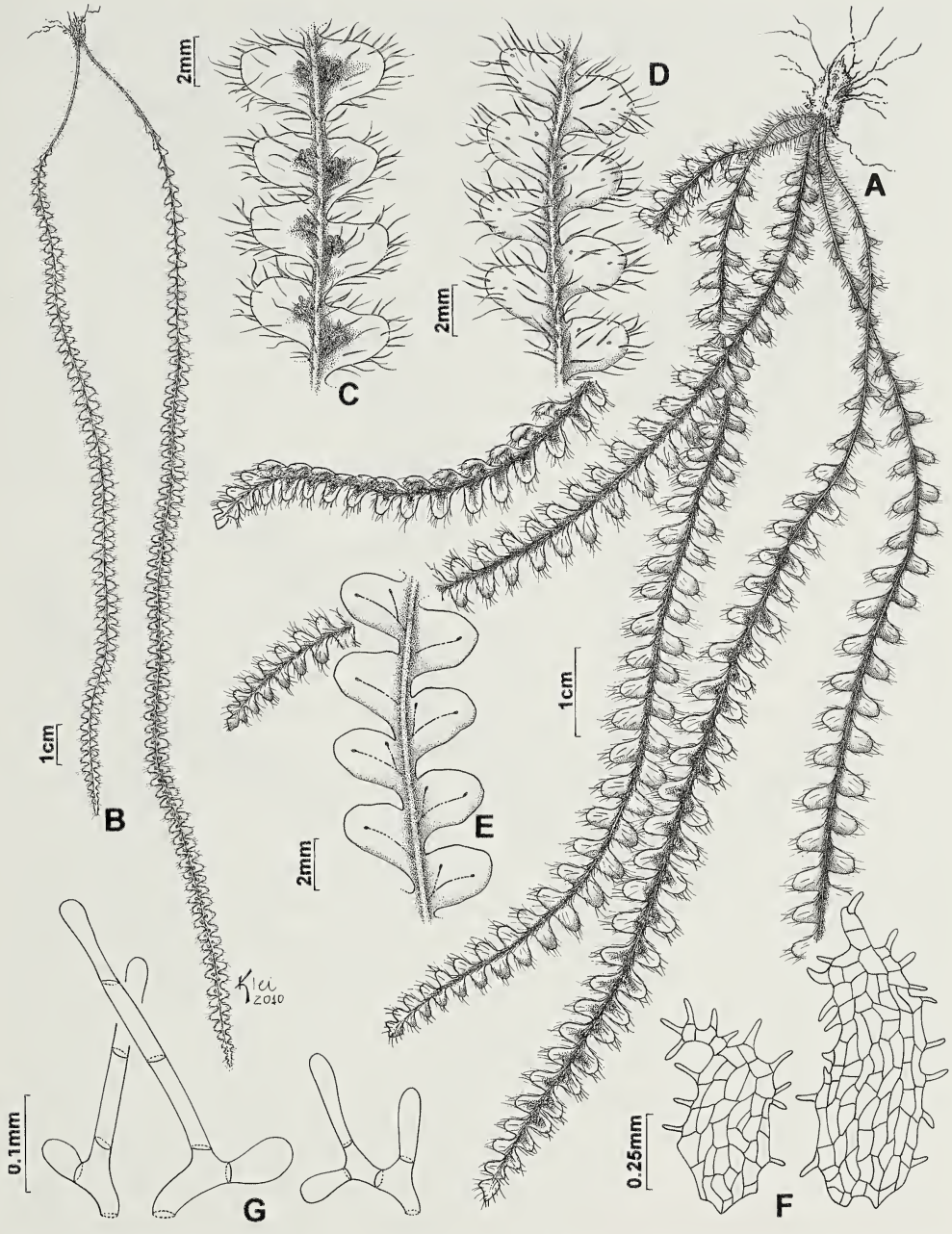

FIG. 18. *Moranopteris killipii*. A, B. Pendent habit. C. Fertile segments showing sori and setae, abaxial view. D. Segments showing setae and hydathodes, adaxial view. E. Venation (cleared lamina). F. Rhizome scales. G. Branched hairs (rehydrated) from costa. A, C–F: *Lehmann 7655* (K). B: *Bittner 2670* (UC).

indeterminate growth, membranaceous laminae, segments mostly ovate, with two hydathodes, and 1-branched hairs with the branch more than twice as long as the main branch (Figs. 18A–G).

Moranopteris caucana and *M. hyalina* are similar to *M. killipii* in having 1-branched hairs, but both differ by having chartaceous laminae and mostly non-gibbous segments. *Moranopteris caucana* and *M. hyalina* also differ from *M. killipii* by the simple veins (Fig. 12D) and rhizome scales with hyaline setiform projections on margins (Fig. 17E), respectively.

11. *Moranopteris knowltoniorum* (Hodge) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium knowltoniorum* Hodge, Amer. Fern J. 31: 105, pl. 1, fig. 4–6. 1941. *Xiphopteris knowltoniorum* (Hodge) Copel., Amer. Fern J. 42: 108. 1952. *Grammitis knowltoniorum* (Hodge) Proctor, Rhodora 63: 35. 1961. *Micropolypodium knowltoniorum* (Hodge) A. R. Sm., Novon 2: 422. 1992. TYPE.—DOMINICA. Morne Trois Pitons, 1400 m, 15 Aug 1938, *W. H. Hodge 54* (holotype: GH-n.v.; isotypes: US-65899, NY-127096). **Figs. 15B, 19.**

Plants epiphytic. *Rhizomes* erect to decumbent with scales 1.9–3.6 × (0.4–)0.7–0.9 mm, these yellow-brown to orange-brown, lanceolate, bases sligthly cordate, apices acute, usually with apical or subapical gland-like cells, margins entire, or rarely with small lateral projections. *Leaves* erect to arcuate, determinate, (6–)8.5–13 cm × (5.5–)7–13 mm, moderately setose; *stipes* 0.1–0.2 cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, membranaceous, rarely slightly chartaceous; *costae* obscured by laminar tissue abaxially and adaxially, sometimes weakly visible or visible at bases with dark sclerenchyma abaxially; *segments* ascending, mostly 65–80° to costae, (20–)28–33 pairs, 0.6–1.2(–2.0) mm apart, subopposite, gibbous, rarely slightly gibbous, asymmetric, (3.0–)3.4–7.0 × 2.0–3.2 mm, oblong to oblong-lanceolate, rarely deltate, mainly at bases, decurrent, apices rounded to acute, margins plane, with hyaline or yellowish cells, these sometimes inconspicuous; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2(3) hydathodes per segment, elliptic to linear; *setae* (0.6–)1.2–2.2(–3.2) mm long, dark red-brown, on all sides of costae and laminar tissue; *hairs* present on costae and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, or sometimes with branches tinged red-brown, 1- or 2-branched, the main branch 2- or 3-celled, 0.10–0.15(–0.20) mm long, 1st branch (2-)3–5-celled, 0.15–0.3(–0.4) mm long, this branch mostly at least twice as long as the main branch and tinged red-brown, 2nd branch, if present, 1- or 2-celled, (0.05–)0.10–0.15 mm long. *Sori* one per segment, round, 1.8–2.0 mm diam.

Distribution.—Endemic to the Lesser Antilles (Dominica and Guadeloupe); 600–1400 m.

Selected Specimens Examined.—DOMINICA. Morne Trois Pitons, 1400 m, 23 Feb 1940, *Hodge & Hodge 1431* (B, K, L, NY, PH, S, UC). **Saint Paul**: Trail to

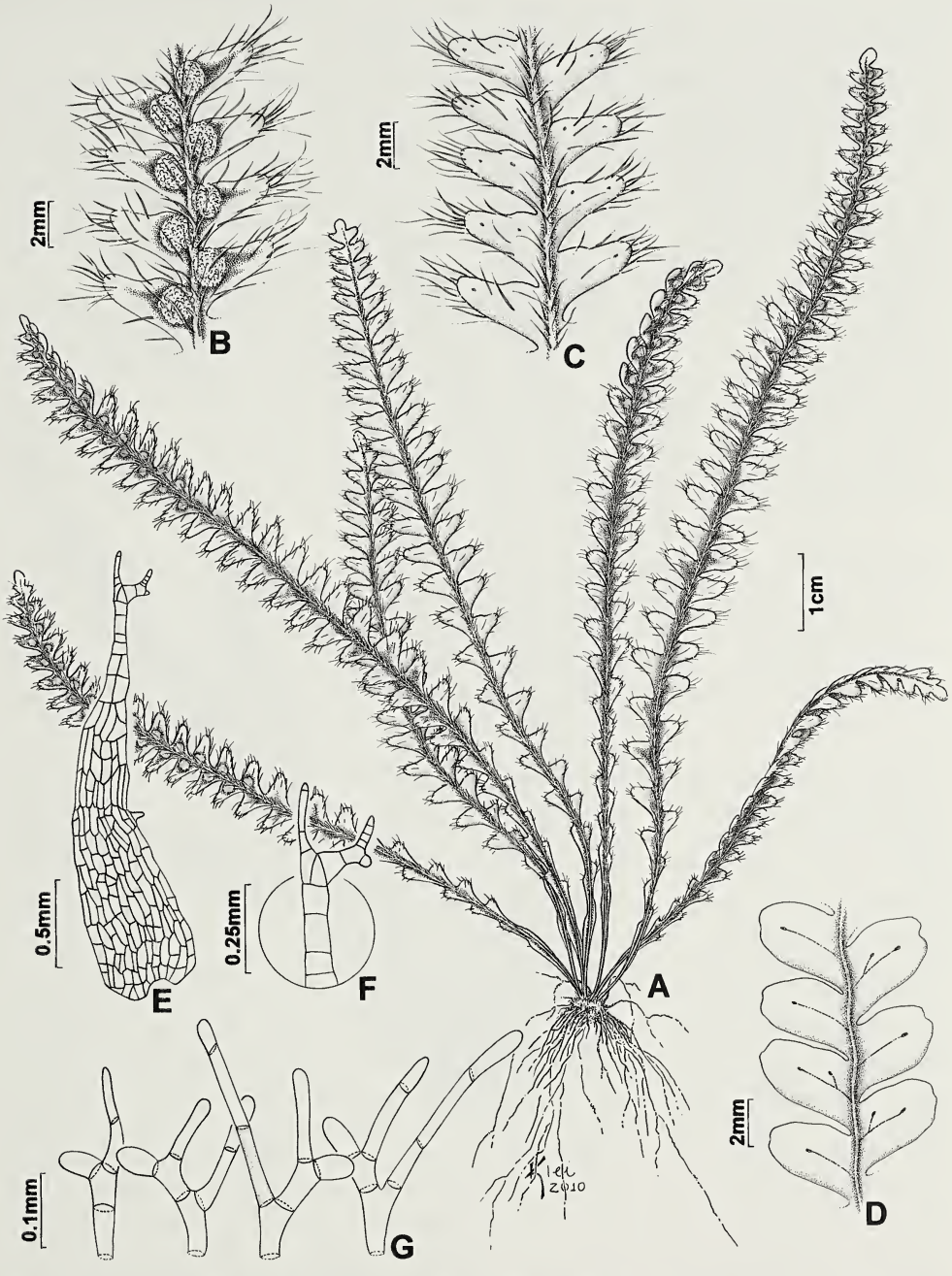

FIG. 19. *Moranopteris knowltoniorum*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina, young segments). E. Rhizome scale. F. Apex of rhizome scale. G. Branched hairs (rehydrated) from costa. A–G: *Hodge & Hodge 1431* (NY).

summit of Morne Trois Pitons SE of Pont Cass, 1066–1219 m, 15°12′30″N, 61°20′30″W, 27 May 1996, *Hill 27919* p.p. (UC).

GUADELOUPE. Basse Terre, comm. Petit-Bourg-Bouillante, Parc National de la Guadeloupe, route de la Traversée D23, Trace de Mamelle de Pigeon ou Déboulé, 615–768 m, 16°11′N, 61°44′W, 22 Mar 2005, *Christenhusz 4208* (UC).

Moranopteris knowltoniorum can be recognized by rhizome scales with entire margins, furcate veins, two hydathodes per segment, mostly gibbous segments, branched hairs that mostly have the first branch at least twice as long as the main branch, and with some branches tinged red-brown (Figs. 19A–G).

Moranopteris serricula sometimes resembles *M. knowltoniorum*, and both species occur in the Lesser Antilles. But *M. serricula* differs in having setate stipes 1.1–3.5 cm long (vs. 0.1–0.2 mm long without setae), mostly chartaceous laminae (vs. membranaceous), non-gibbous segments (vs. conspicuously gibbous fertile segments), these mostly 45–60° to the costae (vs. 65–80° to costa) and deltate (vs. mostly oblong to oblong-lanceolate) (Figs. 30A–D). Hodge (1941) used similar characteristics to distinguish both species.

12. *Moranopteris liesneri* (A. R. Sm.) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Grammitis liesneri* A. R. Sm., Ann. Missouri Bot. Gard. 77: 257. 1990. *Micropolypodium liesneri* (A. R. Sm.) A. R. Sm., Novon 2: 422. 1992. TYPE.—VENEZUELA. **Amazonas**: Atabapo, base of cliff and forest below it on slope of Huachamacarí, 03°39′N, 65°43′W, 1000–1300 m, 5 Mar 1985, *R. L. Liesner 18241* (holotype: UC-1535652). **Figs. 3F, L, 15B, 20.**

Plants epipetric. *Rhizomes* erect to decumbent with scales 1.0–1.6 × 0.3–0.5 mm, these golden to slightly yelllow-brown, ovate-lanceolate to lanceolate, bases cordate, apices acute, with apical or subapical gland-like cells, margins with long setiform projections, also with small lateral projections, setiform projections occurring rarely on distal third of scale surfaces, setiform projections red-brown, 0.1–0.4 mm long. *Leaves* erect to arcuate, determinate, 3–7 cm × 4–9 mm, sparsely setose; *stipes* 0.1–0.6 cm long, yellow-brown, wings absent; *laminae* linear, pinnatisect, pinnate at bases, gradually tapering proximally, chartaceous; *costae* mostly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially, or sometimes weakly visible with dark sclerenchyma adaxially; *segments* ascending, mostly 40–45° to costae, 16–30 pairs, 1.0–1.5 mm apart, ± alternate, gibbous, asymmetric, 3.1–5.3 × 0.9–1.7 mm, linear, slightly decurrent, apices acute to rounded, margins plane or slightly revolute, without hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, oblong to linear; *setae* 1.1–2.2 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on costae, and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, mostly unbranched, rarely branched hairs with a setiform branch, 2- or 3-(4-)celled, 0.2–0.3 mm long, rarely 5-celled (0.5 mm long) on the costae adaxially. *Sori* one per segment, round, 0.8–1.5 mm diam.

Distribution.—Endemic to Venezuela; 1000–1800 m.

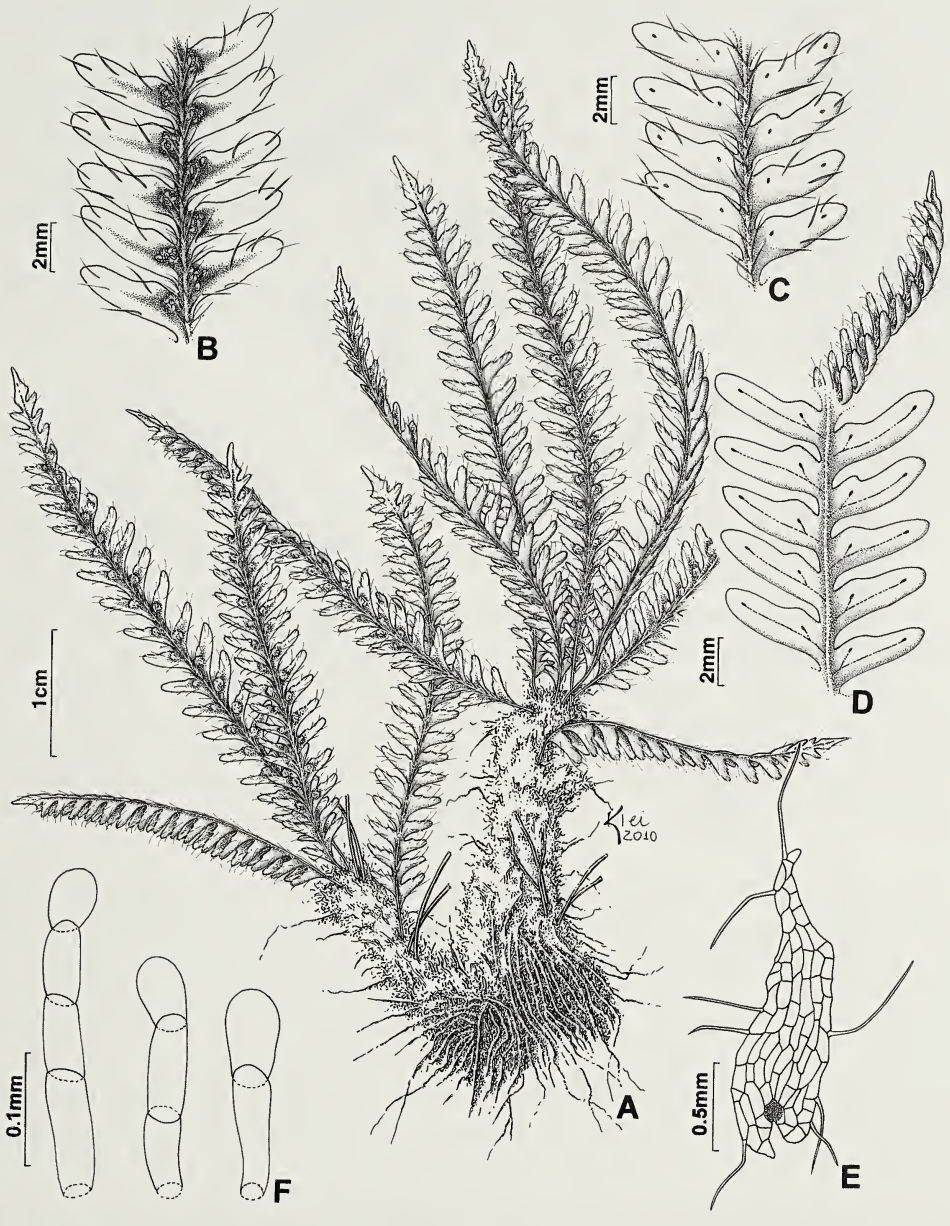

FIG. 20. *Moranopteris liesneri*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Unbranched hairs (rehydrated) from costa. A–F: *Cowan* & Wurdack *31415* (NY).

Specimens Examined.—VENEZUELA. **Amazonas**: Río Ventuari, Caño Asísa, Río Parú, Serranía Parú, 1800 m, 12 Feb 1951, *Cowan & Wurdack 31415* (NY, US).

Moranopteris liesneri is characterized by having sparsely setose leaves, linear segments, unbranched hairs on the costae, and on laminar tissue abaxially (Figs. 20A–F). This species also has branched hairs with a setiform branch, but these are less numerous than the unbranched hairs.

Moranopteris liesneri is known from only two Venezuelan collections. Consequently, the morphological limits of this species are unclear. For instance, Smith (1990) described this species as having simple veins and one hydathode per segment, but *Cowan & Wurdack 31415* has furcate veins and two hydathodes per segment.

13. *Moranopteris longisetosa* (Hook.) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium longisetosum* Hook., Sp. Fil. 4: 225. t. 278 A. 1864. *Terpsichore longisetosa* (Hook.) A. R. Sm., Novon 3: 487. 1993. LECTOTYPE (designated by Smith, 1995).—ECUADOR. Andes Quitensis, s.d., *W. Jameson 79* (K-575419; isolectotype: LE s.n.). **Figs. 3D, I, N, 15B, 21.**

Polypodium myriophyllum Mett. ex Hook. & Baker, Syn. Fil. 338. 1868. *Ctenopteris myriophylla* (Mett. ex Hook. & Baker) Copel., Philipp. J. Sci. 84: 412. 1956. *Grammitis myriophylla* (Mett. ex Hook. & Baker) C. V. Morton, Contr. U.S. Natl. Herb. 38: 108. 1967. *Xiphopteris myriophylla* (Mett. ex Hook. & Baker) Crabbe, Brit. Fern Gaz. 9: 319. 1967. LECTOTYPE (here designated).—PERU. **Puno**: Tatanara, Aug 1854, *W. Lechler 2567* (K-575420; isolectotypes: K-575421; L-795476; frag. US-2138364).

Plants epiphytic, epipetric, or terrestrial. *Rhizomes* short-creeping with scales 0.6–1.4 × 0.4–0.6 mm, these yellow-brown, rarely castaneous, ovate to slightly ovate-lanceolate, bases slightly cordate, apices acute, with apical or subapical gland-like cells, margins with glanduliform projections. *Leaves* erect to pendent, determinate, 12.5–35.5 × 1.5–5.4 cm, sparsely to moderately setose; *stipes* 2.8–12.0(–24.5) cm long, dark brown, wings absent; *laminae* oblanceolate to linear-lanceolate, pinnate-pinnatisect, sometimes pinnate-pinnatifid, gradually tapering proximally, membranaceous; rachises and costae visible with dark sclerenchyma abaxially and adaxially, sometimes only weakly visible with dark sclerenchyma adaxially; pinnae ascending, 30–45°(–60) to rachises, 19–40 pairs, 1.0–3.0 mm apart, alternate to subopposite in pinnate-pinnatifid laminae, not gibbous, symmetric, 6.0–70.0 × 2.0–7.5 mm, linear, pinnatisect or pinnatifid, slightly decurrent, apices attenuate, sometimes rounded to acute, margins plane, with hyaline cells, sometimes inconspicuous; segments (1.4–)2.0–4.2 × 0.3–0.6(–1.4) mm; *veins* pinnate, inconspicuous, > 2 hydathodes per pinnae, linear to elliptic; *setae* 1.0–3.0 mm long, dark red-brown, sometimes yellowish, on all sides of stipes, rachises, costae, and laminar tissue; *hairs* present on stipes, rachises, costae and laminar tissue (mainly near costae abaxially),

FIG. 21. *Moranopteris longisetosa*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Branched hairs (rehydrated) from costa. A–C: *Herrera 3670* (UC). D–F: *Rojas 3209* (NY).

hyaline, slightly red-brown, 1–3-branched, the main branch 2- or 3-celled, (0.05–)0.15–0.20 mm long, 1st branch 1- or 2-celled, (0.1–)0.15–0.30 mm, 2nd branch 1-celled, < 0.1 mm long, 3rd branch, if present, 1-celled, < 0.1 mm long. *Sori* > 2 per segment, round, 1.0–1.4 mm diam.

Distribution.—Costa Rica, Venezuela, Colombia, Ecuador, Peru, and Bolivia; 750–3850 m.

Selected Specimens Examined.—COSTA RICA. **Puntarenas**: Cantón de Buenos Aires, Ujarrás, Bosque Aledaño al Páramo, ladera Atlántica, Cerro Dúrika, 3000 m, 09°22′10″N, 83°17′45″W, 13 Oct 1989, *Herrera 3670* (UC). **Puntarenas-Limón border**: Cordillera de Talamanca, between Cerro Kasir and Cerro Nai, continental divide, 2900–3050 m, 09°12′13″N, 83°03′30″W, 22 Mar 1984, *Davidse et al. 25822* (L, UC). **San José**: Between Itamut and Bine peaks, Fabrega massiff, Bocas del Toro, Panama, 3200 m, 5–9 Mar 1984, *Gómez 22531* (UC).

VENEZUELA. **Trujillo**: Páramo and cloud forest, Páramo de Guaramacal, 762–914 m, 3 Feb 1987, *van der Werff et al. 8800* (K, MO, UC).

COLOMBIA. **Boyacá**: Arriba de la carretera Tunja-Arcabuco, en la quebrada afluente del río Pómeca, 3200 m, 17 Oct 1967, *Jaramillo et al. 3704* (GH, MO).

ECUADOR. **Azuay:** Along road Gualaceo-El Limon, scrub and páramo, 3100–3500 m, 25 Aug 1989, *van der Werff & Gudiño 11456* (UC). **Carchi**: Páramo El Angel, pass on road El Angel-Tulcán, 3750–3850, 00°41′N, 78°54′W, 15 May 1973, *Holm-Nielsen et al. 5479* (UC). **Tungurahua**: Santiago de Pillaro, Parque Nacional Llanganates, slope above south shore of Pisayambo reservoir, near road, 3650 m, 01°04′34″S, 78°24′00″W, 26 Aug 1999, *Neill et al. 11886* (MO, UC).

PERU. **Cuzco**: La Convención, Cordillera Vilcabamba, ca. 23 km walking distance NE from the Hacienda Luisiana and the Apurimac River, 3000 m, 12°30′S, 74°30′W, 15 Jul 1968, *Dudley 11134A* (GH). **Pasco**: Oxapampa, Parque Nacional Yanachaga-Chemillén, Abra la Esperanza, 2800 m, 10°31′S, 75°20′W, 23 Mar 2003, *Monteagudo et al. 4794* (UC).

BOLIVIA. **Cochabamba**: José Carrasco Torrico, 104 km antigua carretera Cochabamba-Villa Tunari, 3150 m, 17°11′S, 65°40′W, 25 Jun 1996, *Kessler et al. 6684* (NY, UC). **La Paz**: Franz Tamayo, PN-ANMI Madidi, senda Pelechuco-Mojos, localidad Tambo Quemado (lugar para acampar), bajando por el sendero, poco después del 2° río, 3470 m, 14°41′S, 68°58′W, 29 Apr 2003, *Jiménez 1770* (MO, UC).

Moranopteris longisetosa has rhizome scales with glanduliform projections on the margins, pinnate leaves and pinnate veins (Figs. 21A–E). This species varies in laminar dissection, from pinnate-pinnatisect to pinnate-pinnatifid (in some specimens from Ecuador).

Moranopteris achilleifolia, the most similar species, can be distinguished by its rhizome scales with entire margins (see comments under that species) (Fig. 6E).

As discussed by Smith (1993) and Smith and Moran (1995), *Polypodium piligerum* Hook. may be synonymous. That name was based on a specimen from Ecuador, the type locality of *Polypodium longisetosum*. However, Hooker (1841) described that taxon as having rhizome scales that are "nigro-fuscentibus, nitidis" and *Moranopteris* has lighter colored rhizome scales.

Unfortunately, the type of *P. piligerum* was not located at K. Consequently this name is here treated as of uncertain application. If *Polypodium piligerum* proves to be the same species, it has priority over *Moranopteris longisetosa*.

14. *Moranopteris microlepis* (Rosenst.) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium blepharodes* Maxon var. *microlepis* Rosenst., Repert. Spec. Nov. Regni Veg. 22: 14. 1925. LECTOTYPE (designated by Lellinger, 1989).—COSTA RICA. Tablazo, 1900 m, 4 Mar 1908 [as "Feb"], *A. C. Brade 80b* (S-R5044; isolectotype: UC-405706). **Figs. 3K, 14, 23A.**

Plants epiphytic. *Rhizomes* erect with scales 0.3–0.8 × 0.2–0.3 mm, these castaneous, ovate to lanceolate, bases cordate to subcordate, apices attenuate to acute, margins with long, red-brown setiform projections, rarely setiform projections occurring on the scale surfaces, 0.3–0.5 mm long, cells of scales often tinged red-brown. *Leaves* erect to arcuate, determinate, 4.0–20.5 cm × 4.0–11.5 mm, moderately to densely setose; *stipes* 0.3–1.1 cm long, yellow-brown to dark brown, wings absent; *laminae* linear, pinnatisect, rarely pinnate at bases, gradually tapering proximally, chartaceous; *costae* weakly visible to visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, mostly 60–80° to costae, 22–49 pairs, 0.5–1.4 mm apart, subopposite, gibbous to slightly gibbous, asymmetric, (1.4–)2.8–5.6 × (1.0–)1.5–2.5 mm, oblong, slightly decurrent, apices rounded to acute, margins plane to slightly revolute, without hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, oblong, obovate, to sometimes round; *setae* 1.0–3.9 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on costae and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, or sometimes with branches tinged red-brown, branched or rarely unbranched, the branched hairs with (1-)2-branched, the main branch 2- or 3-celled, (0.05–)0.15 mm long, 1st branch 1- or 2-(3-)celled, 0.1–0.2(–0.3) mm long, 2nd branch, if present, 1- or 2-celled, (0.05–)0.15 mm long, the unbranched hairs, if present, 1- or 2-celled. Sori one per segment, round, 1.8–2.2 mm diam.

Distribution.—Costa Rica, Panama, Jamaica, and Guadeloupe; 600–2800 m.

Selected Specimens Examined.—COSTA RICA. **Cartago**: Cuericí Reserve, road to the east just E of Villa Mills, 15 Jan 1999, *Smith 2584* (UC). **Heredia**: Transect trail between Volcán Barva and La Selva Biological Station, atlantic slope of Volcán Barva, 1400 m, 2003, *Kluge s.n.* (UC). **Puntarenas**: Cantón de Puntarenas, P. N. Isla del Coco, Isla del Coco, Sendero a Cerro Iglesias, entre la punta de Cerro Pelon y Cerro Iglesias, 530 m, 5°31′55″N, 87°04′45″W, 17 Jun 1997, *Rojas 3603* (NY). **San José**: About 10 km N of San Rafael de Heredia on Volcán Barba, 1950 m, 9 Jul 1967, *Bishop 833* (UC).

PANAMA. **Chiriquí**: Bugaba, Santa Clara, to Cerro Pando, 08°50′N, 82°44′W, 28 Feb 1985, *van der Werff & Herrera 7295* (UC). **Chiriquí-Bocas del Toro:** trail along continental divide to ca. 3 km E of Cerro Pate Macho, 2000–2200 m, 08°49′N, 82°23′W, 7 Feb 1986, *Smith et al. 2426* (NY, UC).

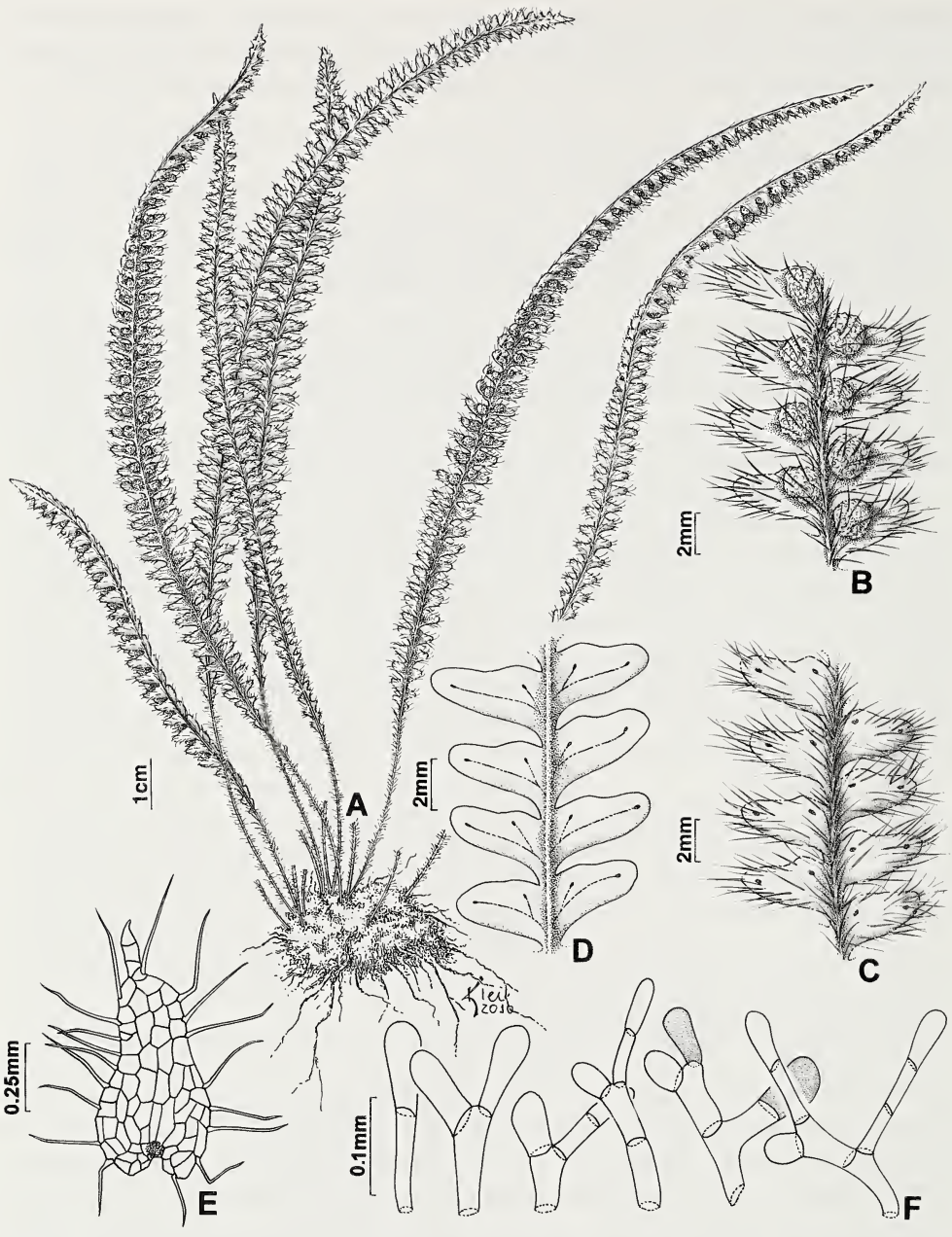

Fig. 22. *Moranopteris microlepis*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Unbranched and branched hairs (rehydrated) from costa. A–C: *Smith 2426* (UC). D, F: *Kluge 2003* (UC). E: *Rojas 3603* (NY).

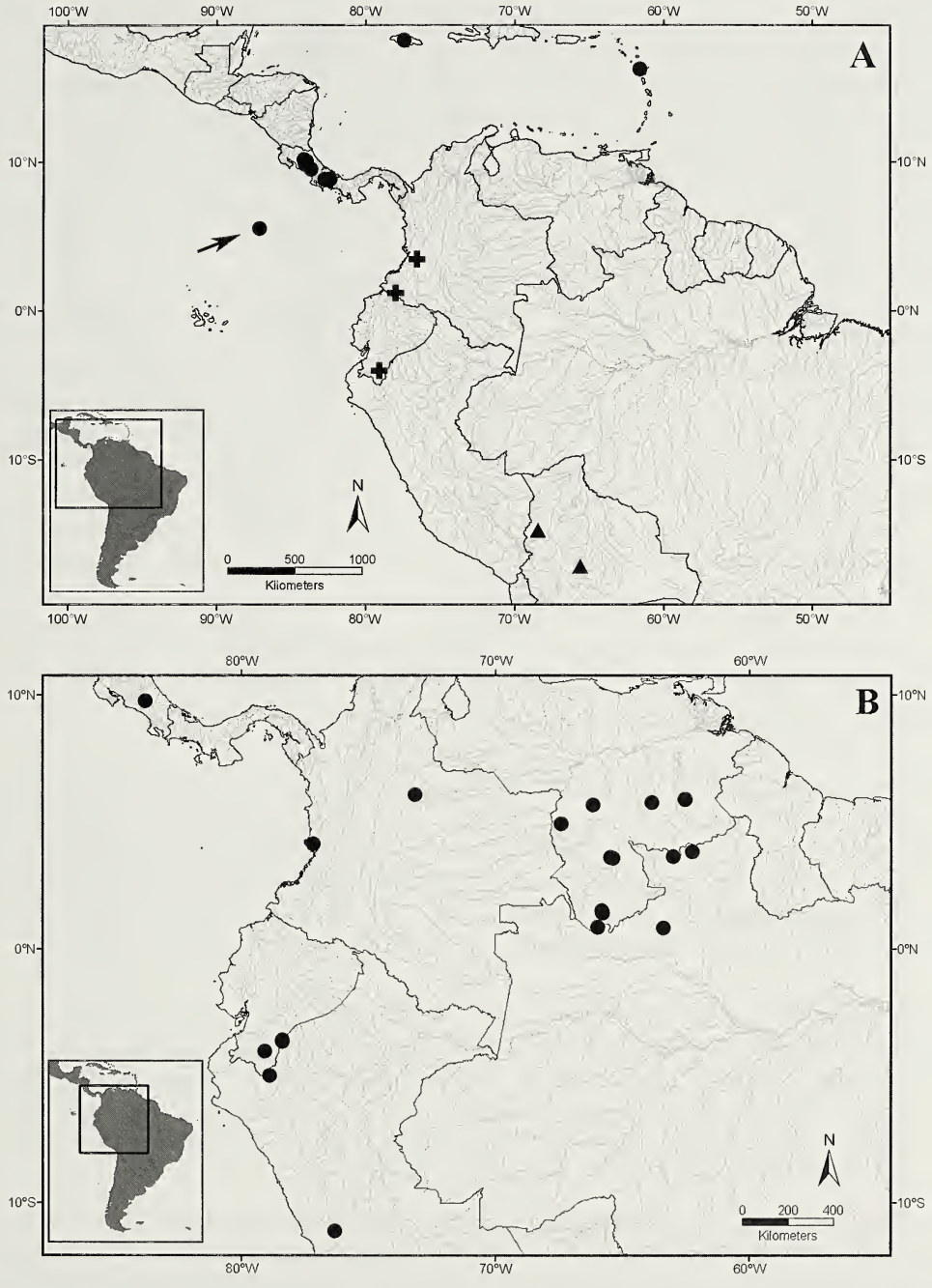

FIG. 23. A. Distribution of *Moranopteris microlepis* (●), *M. killipii* (+), and *M. williamsii* (▲). The arrow points to Cocos Island. B. Distribution of *M. plicata* (●).

JAMAICA. Tweedside, 609–914 m, 10–13 Apr 1903, *Underwood 2107* (NY). GUADELOUPE. s.d., *L' Herminier s.n.* (L).

Moranopteris microlepis is characterized by rhizome scales with red-brown long setiform projections on the margins, moderately to densely setose leaves, furcate veins, two hydathodes per segment, and mostly branched hairs, these mainly near and on the costae abaxially (Figs. 22A–F). When branched, these hairs are tinged red-brown, which can be helpful in recognizing this species. The rhizome scales vary from ovate (e.g., specimens from Costa Rica) to lanceolate (e.g., specimens from Jamaica).

Moranopteris plicata is similar to *M. microlepis* but this species can be distinguished using a combination of characters. The most reliable are associated with the fertile segments, gibbous and slightly ascending segments in *M. microlepis* vs. mostly non-gibbous and ascending segments in *M. plicata* (Fig. 28C). Another similar species is *M. truncicola* which differs in having a variable laminar dissection — pinnatifid, deeply pinnatifid, or pinnatisect, and mostly membranaceous, with non-gibbous segments (Fig. 37C).

Lelllinger (1989) synonymized *Polypodium blepharodes* Maxon var. *microlepis* Rosenst. under *Grammitis blepharodes* (Maxon) F. Seym. But, this last species is synonym of *Moranopteris taenifolia.*

The lectotype of *Polypodium blepharodes* var. *microlepis* was selected by Lellinger (1989), but the specimen at S (isolectotype UC) shows a different date than that given in the protologue. It is probably only a minor error by Rosenstock (1925) when he published the variety.

15. *Moranopteris nana* (Fée) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium nanum* Fée, Gen. Filic. 5: 238. 1852. *Xiphopteris nana* (Fée) Copel., Amer. Fern J. 42: 107. 1952. *Micropolypodium nanum* (Fée) A. R. Sm., Novon 2: 422. 1992. LECTOTYPE (here designated).—FRENCH GUIANA. Without exact locality: s.d., *F. M. R. Leprieur s.n.* ["140"] (P-696190; isolectotypes: P-696243 p.p., B-200142439). **Figs. 24, 25A.**

Polypodium exiguum Fée, Crypt. Vasc. Br. 1: 89, t. 37, f. 1. 1869, *nom. illeg., non* Heward (1838), *nec* Griseb. (1864). *Polypodium blanchetii* C. Chr., Bot. Tidsskr. 25: 78. 1902. *Grammitis exigua* (Fée) Brade, Sellowia 18: 79. 1966, *nom. illeg. Grammitis blanchetii* (C. Chr.) A. R. Sm., Ann. Missouri Bot. Gard. 77: 257. 1990. LECTOTYPE (here designated).—BRAZIL. **Bahia:** 1857, *J. S. Blanchet 8* (RB-31739; isolectotype: P-n.v.).

Plants epiphytic, rarely epipetric. *Rhizomes* erect with scales 0.5–1.1 × 0.15–0.30 mm, these yellow-brown to orange-brown, ovate-lanceolate to lanceolate, bases cordate, apices acute, margins with long setiform projections mostly on distal third, these red-brown, 0.1–0.2(–0.3) mm long. *Leaves* erect to arcuate, determinate, (1.6–)5.0–8.0(–12.0) cm × (2.9–)4.0–5.5 mm, sparsely to moderately setose; *stipes* (0.1–)0.5–1.0 cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, rarely pinnate at bases, gradually tapering proximally to a narrow wing, chartaceous; *costae* weakly visible to visible with

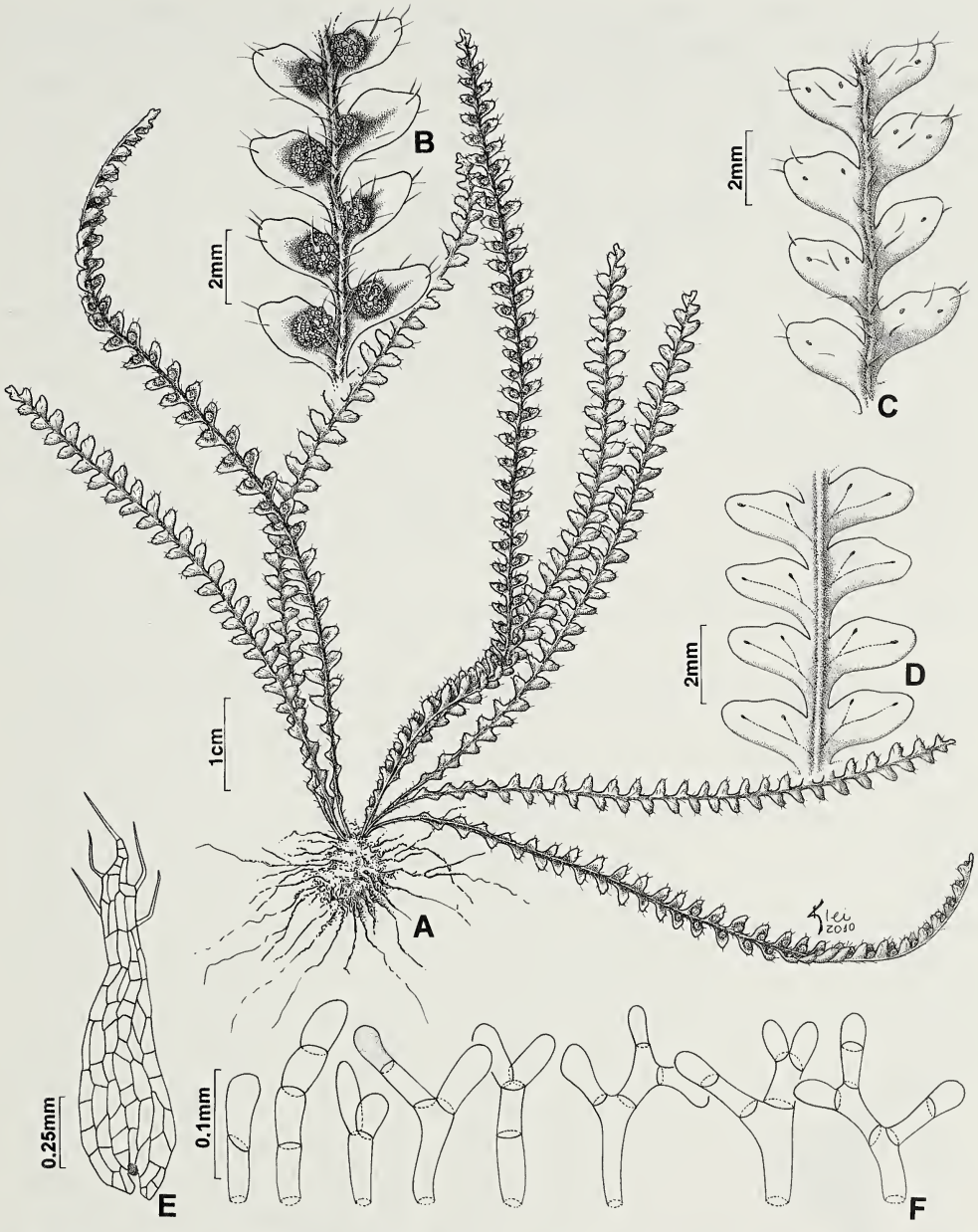

FIG. 24. *Moranopteris nana*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Unbranched and branched hairs (rehydrated) from costa. A–C: *Cid et al. 590* (INPA). D: *Lopes & Pietrobom 518* (SP). E–F: *Cremers 7260* (CAY).

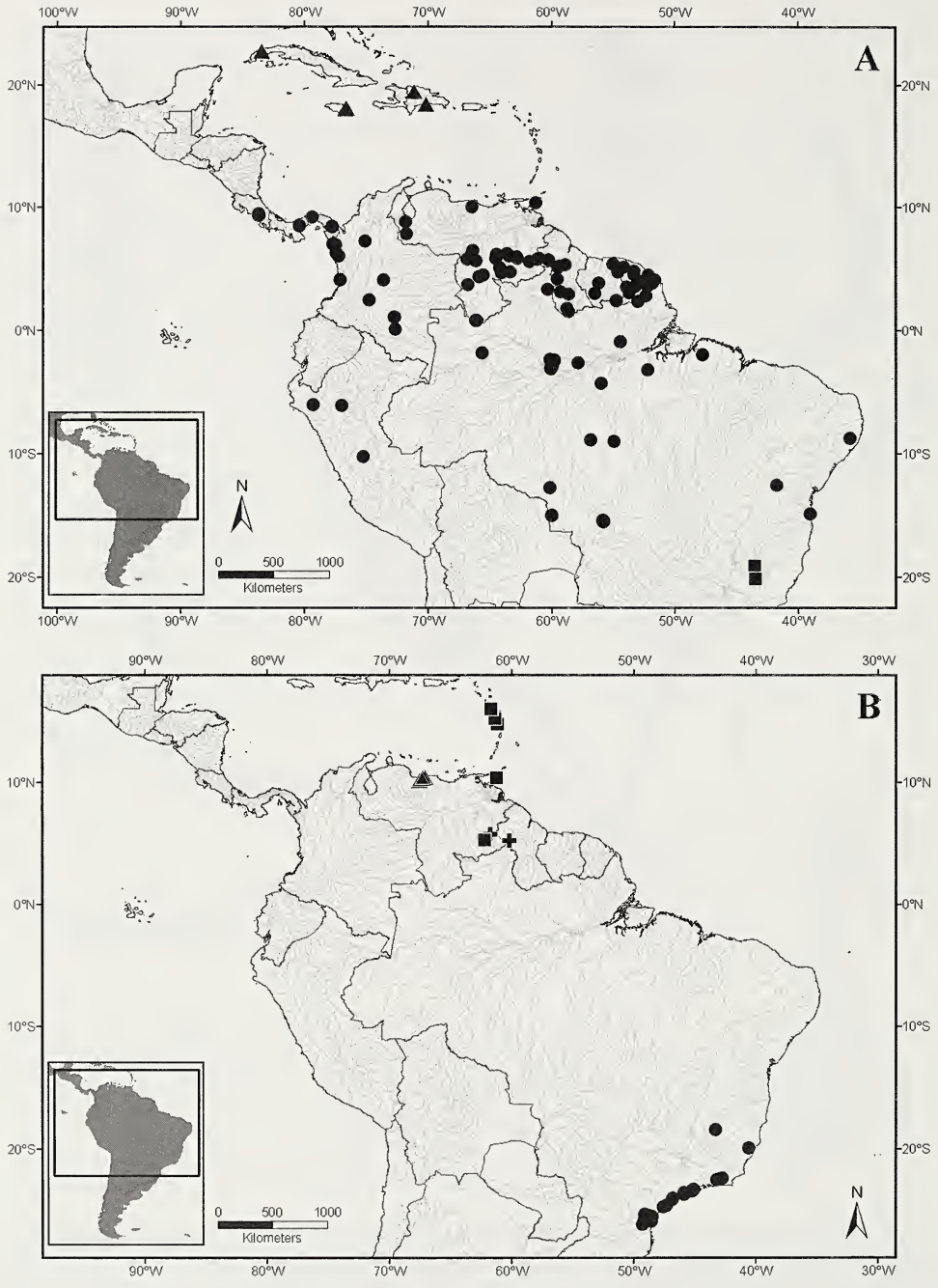

FIG. 25. A. Distributions of *Moranopteris nana* (●), *M. nimbata* (▲)[except North Carolina], *M. perpusilla* (■). B. Distributions of *M. rupicola* (+), *M. serricula* (■), *M. setosa* (●), and *M. simplex* (▲).

dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, mostly (45–)60–85° to costae, (7–)22–39(–50) pairs, (0.2–)1.2–1.7 mm apart, alternate to subopposite, gibbous, asymmetric, (1.0–)1.6–3.2 × 0.9–1.7 mm, ovate to oblong, sometimes deltate, decurrent, apices rounded to slightly acute, margins plane to slightly revolute, without hyaline cells or these inconspicuous; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, elliptic to obovate; *setae* (0.3–)0.6–1.3(–1.6) mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on costae and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, or rarely with branches tinged red-brown, branched or rarely unbranched, rarely branched hairs with a setiform branch, the unbranched hairs with 2- or 3-(4-)celled, (0.05–)0.15(–2.0) mm long, the branched hairs 1- or 2-branched, the main branch 2- or 3-celled, (0.05–)0.2 mm long, 1st branch 1- or 2-celled, (0.05–)0.1(–0.35) mm long, 2nd branch, if present, 1- or 2-celled, (0.05–)0.10(–0.15) mm long. *Sori* one per segment, round, (0.5–)1.2–1.5 mm diam.

Distribution.—Costa Rica, Panama, Trinidad and Tobago (restricted to the island of Trinidad), French Guiana, Suriname, Guyana, Venezuela, Colombia, Peru, and Brazil; 5–1400 m.

Selected Specimens Examined.—COSTA RICA. **San José**: San Isidro del General, 670 m, 26 Jul 1940, *Chrysler & Roever 5246* (NY).

PANAMA. **Coclé**: Bismarck, above Penonome, 609–914 m, 5–19 Mar 1908, *Williams 452* (NY). **Darién**: Tres Bocas on the Río Coasi, 1 May 1968, *Kirkbride & Duke 1380* (NY). **Panamá**: Subida para Cerro Jefe, 700 m, 13 Mar 1969, *Sucre et al. 4860* (RB).

TRINIDAD AND TOBAGO. **Trinidad**: Aripo road, on a tree-trunk, in a gully, near 2 mile post, 19 Mar 1926, *Broadway 6061* (K).

FRENCH GUIANA. Au bord d'une crique, Riv. Mana, près de Saut Dalles, 20 Jul 1981, *Cremers 7260* (CAY); Crique Kapiri, R. N. 2, Bassin de l'Approuague, 70 m, 04°07′N, 52°05′W, 16 Jan 1991, *Cremers 11632* (CAY, P, UC, US); Crique Voltaire, Bassin du Maroni, 05°09′N, 54°10′W, 15 May 1988, *Feuillet 9844* (CAY); Face Nord de la Montagne de Kaw, 13 May 1985, *Cremers 8687* (CAY); Mont Galbao, secteur Est., 600 m, 03°36′N, 53°17′W, 14 Jan 1986, *Granville et al. 8677* p.p. (US); Mont Saint-Marcel, zone Sud-est du massif, 280 m, 02°23′00″N, 53°00′20″W, 23 Jul 2002, *Granville et al. 15439* (CAY).

SURINAME. **Sipaliwini**: In montibus, qui dicuntur Nassau, on dead log, in forest near km 7.5, 11 Mar 1949, *Lanjouw & Lindeman 2592* (US).

GUYANA. **Cuyuni-Mazaruni**: Paruima, 9 km W, Ararata scrub area, 800 m, 05°49′N, 61°08′W, 4 Jul 1997, *Clarke et al. 5348* (CAY, US). **U-Takutu-U. Essequibo**: Rewa River, summit of unnamed peak, 5.6 km W of camp, 400 m, 02°58′49″N, 58°38′27″W, 19 Feb 1997, *Clarke 3685* (NY, US). **Potaro-Siparuni**: Kaieteur Falls National Park, relatively moist forest along trail to Tukeit, 500 m, 05°10′N, 59°29′W, 17 Apr 1988, *Hahn et al. 4721* (US).

VENEZUELA. **Amazonas**: Atabapo, Serranía del Parú (Aroko), Sabanas sobre colinas onduladas en el sector centro-nororiental de la serranía, al S del Río Parú, 710 m, 04°33′N, 65°31′W, 5–6 Oct 1979, *Huber 4353* (US). **Bolívar**:

Caño Pablo, tributary of Río Caura, ca 6 km ESE of Lãs Pavas (Salto Para), 240 m, 06°14′N, 64°24′W, 8 May 1982, *Liesner & Morillo 13928* (VEN). **Miranda**: Parque Nacional de Guatopo, 610–710 m, 29 Nov 1961, *Steyermark 90175* (US). **Táchira**: Uribante, Empresa Las Cuevas near La Fundación, 900 m, 08°50′N, 71°47′W, 7 Jul 1983, *van der Werff & González 5005* (MO, UC).

COLOMBIA. **Antioquia**: Anorí, Región Providencia, sector Aljibes-La Tirana, desembocadura de la quebrada Buenos Aires al Río Anorí, 500 m, 07°17′36″N, 75°04′02″W, 18 Jan 2004, *Rodríguez et al. 4500* (HUA, NY). **Caquetá**: Sierra de Chiribiquete, Bosque más cercano a la Cueva de las Pinturas, 600 m, 01°05′N, 72°40′W, 24 Aug 1992, *Palacios et al. 2579* (MO, NY). **Chocó**: Camp Curiche, S. of Boca Curiche, 26 May 1967, *Duke 11675* (MO, US). **Meta**: about 20 km SE of Villavicencio, 500 m, 17 Mar 1939, *Killip 34287* (US).

PERU. **Pasco**: Oxapampa, Palcazu valley, Cabeza de Mono, 5–6 km west of Iscosacin, 325 m, 10°12′S, 75°14′W, 13–19 Apr 1983, *Smith 3805* (MO).

BRAZIL. **Amapá**: Rio Oiapoque, near first cachoeira on Rio Iaue, 02°53′N, 52°22′W, 24 Aug 1960, *Irwin et al. 47778* (NY, US). **Amazonas**: Itapiranga, Rio Uatumã, lado esquerdo do Igarapé Catitu, passando a antiga Usina de Pau-Rosa, 20 Aug 1979, *Cid et al. 590* (INPA); Manaus-Caracaraí Road, km 26, trilha subindo o Barro Branco, 02°53′S, 59°58′W, 14 Mar 1995, *Prado et al. 590* (INPA, SP). **Bahia**: Ilhéus, s.d., *Riedel s.n.* (P). **Mato Grosso**: Chapada dos Guimarães, 16 Nov 1975, *Hatschbach 37625* (UC, MBM). **Pará**: Macau airstrip, 1h e meia upstream from Lageira airstrip, on Rio Maicurú, 243 m, 00°55′S, 54°26′W, 24 Jul 1981, *Strudwick et al. 3524* (INPA, NY, US). **Pernambuco**: Jaqueira, Usina Colônia, mata córrego da Guatiba, 652 m, 08°43′00″S, 35°50′25″W, 6 Dec 2001, *Lopes & Pietrobom 518* (MBM, RB, SP). **Rondônia**: Vilhena, Estrada que vai para Aripuanã, local Fazenda Flor da Serra, a 15 km de Vilhena, 20 May 1984, *Rosário et al. 443* (MG). **Roraima:** Rio Branco, Surumú, "Serra de Meivary", 1100 m, Nov 1909, *Ule 13* (B).

Moranopteris nana has sparsely setose leaves, furcate veins, two hydathodes per segment, mostly ovate, gibbous segments, and rhizome scales with setiform projections along the distal third (Figs. 24A–E).

Moranopteris nana is variable in its hairs, which occur near and on the costae abaxially. These hairs are mostly 1- or 2-branched, or sometimes also unbranched (Fig. 24F). The branched hairs with a setiform branch are less frequent.

Rodríguez *et al.* 4500 (HUA, NY) is unusual in having gibbous, oblong-lanceolate segments that are more widely spaced. It might represent an undescribed species, but we have not found other specimens to match it and so prefer to interpret it here as only a variation of *M. nana*. Also, the duplicate at NY did not show segments as widely spaced.

The most similar species to *Moranopteris nana* is *M. taenifolia*. They overlap in hair type. However, *M. taenifolia* differs by having moderately setose leaves, and closely spaced segments (0.4–1.0 vs. 1.2–1.7 mm).

Polypodium nanum was based on *Leprieur s.n.* (Herb. Cl. Moug.), s.d., from "Guyana" [French Guiana]. Unfortunately, no material collected by Leprieur

found at B, NY, P, or US had a label bearing "Herb. Cl. Moug." Hieronymus (1905) pointed out that *Leprieur 140* was probably authentic, and we choose this as lectotype (P). Futhermore, this specimen and duplicates match perfectly the protologue. For this collection number, dates are variously indicated as Jun 1834 (P-696190), 1833 (P-696243), or undated (B-200142439).

16. *Moranopteris nimbata* (Jenman) R. Y. Hirai & J. Prado, Taxon 60: 1131. 2011. *Polypodium nimbatum* Jenman, J. Bot. 24: 271. 1886. *Xiphopteris nimbata* (Jenman) Copel., Amer. Fern J. 42: 108. 1952. *Grammitis nimbata* (Jenman) Proctor, Bull. Inst. Jamaica Sci. Ser. 5: 34. 1953. *Micropolypodium nimbatum* (Jenman) A. R. Sm., Novon 2: 422. 1992. LECTOTYPE (here designated).—JAMAICA. Without exact locality, s.d., *collector unknown* [J.P. 2067] (US-692161; isolectotypes: IJ-n.v., NY-127088 p.p. "as A"; frag. NY-127087). **Figs. 3P, 25A, 26.**

Plants epiphytic. *Rhizomes* erect with scales 0.8–1.5 × 0.2–0.3 mm, these castaneous, ovate-lanceolate, bases slightly cordate, apices acute, rarely with apical or subapical gland-like cells, margins with long setiform projections, or rarely also with small lateral projections, setiform projections rarely occurring on the scale surfaces, setiform projections red-brown, 0.10–0.15 mm long. *Leaves* erect to arcuate, determinate, 2.0–6.0(–10.0) cm × 3.0–4.5 mm, moderately to densely setose; *stipes* 0.3–0.5 cm long, rarely 1.0 cm, yellow-brown to dark brown, wings absent; *laminae* linear, pinnatisect to deeply pinnatifid, rarely pinnate at bases, gradually tapering proximally, chartaceous; *costae* obscured by laminar tissue abaxially and adaxially, sometimes visible with dark sclerenchyma at bases abaxially; *segments* ascending, 60–70° to costae, (12–)23–32(–51) pairs, 0.2–0.5 mm apart, subopposite, not gibbous, symmetric, 1.3–2.0(–3.0) × 1.0–1.4(–2.0) mm, ovate to oblong, slightly decurrent, apices rounded, margins plane to slightly revolute, without hyaline cells, or these sometimes inconspicuous; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, round; *setae* 0.5–2.1 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on costae and laminar tissue (mainly near costae abaxially), hyaline or slightly red-brown, or sometimes with branches tinged red-brown, (1-)2-branched, the main branch 2- or 3-celled, (0.05–)0.15 mm long, 1st branch 1- or 2-celled, (0.05–)0.1–0.2 mm long, 2nd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, round, 0.9–1.4 mm diam.

Distribution.—U.S.A. (North Carolina; Farrar 1967) and the Greater Antilles (Cuba, Jamaica, and Dominican Republic); 1000–1700 m.

Selected Specimens Examined.—CUBA. Loma del Gato, 1100 m, Aug 1923, *Clement 1007* (P); Sevilla, near Santiago, Jiquarito, Sierra Maestra, 1036 m, 18 Sep 1906, *Taylor 540* (NY).

JAMAICA. Base of John Crow Peak, 1524–1676 m, 18 Apr 1903, *Underwood s.n.* (NY); Cinchona, 1495 m, 19 Mar 1909, *Watt 182* (S); Rose Hill, 12 Mar 1895, *Harris 3180* (K).

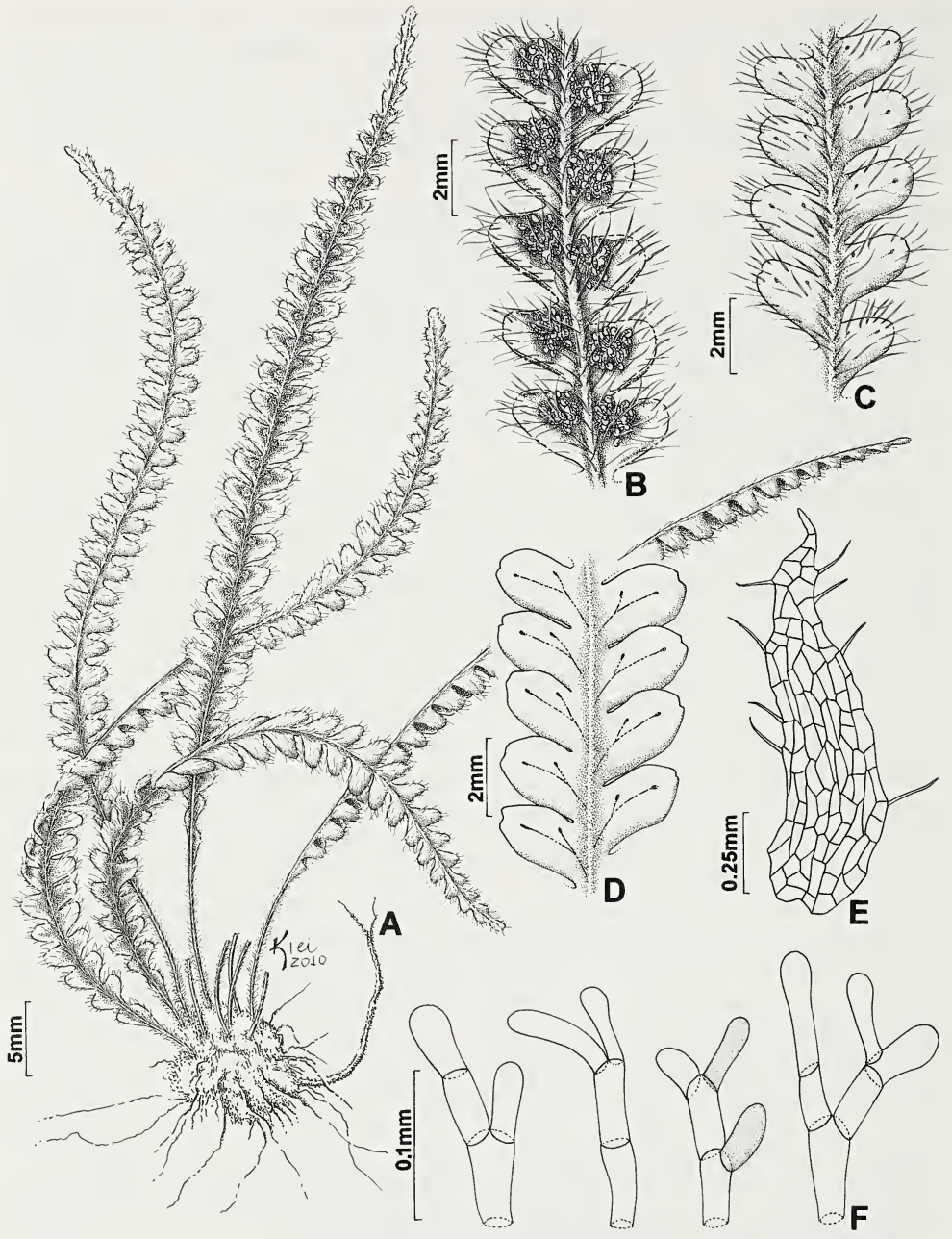

Fig. 26. *Moranopteris nimbata*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Branched hairs (rehydrated) from costa. A–C, E: *Eggers 3685* (P). D, F: *Clement 1007* (P).

DOMICAN REPUBLIC. **San Cristobal-Peravia border**: Cordillera Central, broad-leaved forest (much cut over) along Río Mahoma, 5.3 km E of Piedra Blanca-Rancho Arriba road, from point 19 km SW of Piedra Blanca, 11.2 km NE of Rancho Arriba, 0.7 km NE of La Penita, 1000 m, 28 Feb 1983, *Mickel et al. 9050* (NY). **Santo Domingo**: Cordillera Central, prov. Monte Cristi, Monción, Lagunas de Cenabé, 1200 m, 4 Jun 1929, *Ekman 12732* (B, K, NY, S).

Moranopteris nimbata is recognized by rhizome scales with long red-brown setiform projections on the margins, pinnatisect to deeply pinnatifid laminae, moderately to densely setose, furcate veins, two hydathodes per segment, non-gibbous segments, and branched hairs mainly near and on the costae abaxially (Figs. 26A–F). These hairs sometimes have branches tinged red-brown, and this can be helpful to recognize this species.

Eggers 3685 (B-200149365) and *Wright 1049* (PH) are somewhat unusual by having slightly gibbous segments, but they agree with *Moranopteris nimbata* in all other characteristics.

Moranopteris nimbata can be sometimes confused with *M. microlepis* and *M. basiattenuata*, but these last two differ respectively by having gibbous segments and rhizome scales with entire margins.

The isolectotype at NY-127088 is mixed with *Moranopteris trichomanoides* and it was indicated on the sheet "as B".

17. *Moranopteris perpusilla* (Maxon) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Polypodium perpusillum* Maxon, Contr. U.S. Natl. Herb. 17: 409. pl. 13-A. 1913. *Xiphopteris perpusilla* (Maxon) Copel., Amer. Fern J. 42: 95. 1952. *Micropolypodium perpusillum* (Maxon) A. R. Sm., Novon 2: 422. 1992. TYPE.—BRAZIL. **Minas Gerais**: Serra do Caraça, Mar 1892, *E. Ule s.n.* (holotype: US-534909; isotypes: P-632717, P-632718). **Figs. 5A, B, 25A, 27.**

Plants epipetric. *Rhizomes* erect with scales 1.1–2.7 × 0.4–0.65 mm, these golden to yellow-brown, ovate-lanceolate, rarely ovate, bases cordate, apices acute, margins entire, or rarely with small lateral projections. *Leaves* erect to arcuate, determinate, 1.7–4.7 cm × 2.0–3.0 mm, not setose; *stipes* 0.2–0.7 cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costae* visible with dark sclerenchyma abaxially and adaxially; *segments* ascending, 30–45° to costae, 9–16 pairs, 0.4–0.8 mm apart, subopposite, alternate at bases, not gibbous, symmetric, 1.1–2.0 × 0.7–1.0 mm, oblong to deltate, decurrent, apices rounded, margins slightly revolute, without hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, elliptic; *setae* absent; *hairs* present on stipes, costae, and laminar tissue (mainly near costae abaxially), yellowish, slightly red-brown, unbranched and branched, the unbranched hairs 3–5-(6-)celled, 0.1–0.4 mm long, the branched hairs 1- or 2-branched, the main branch 3- or 4-celled, 0.15–0.30 mm long, 1st branch 1–3-celled, (0.05–)0.15–0.25 mm long, 2nd branch, if present, 1- or 2-celled, < 0.1 mm long. *Sori* one per segment, round, 0.9–1.2 mm diam.

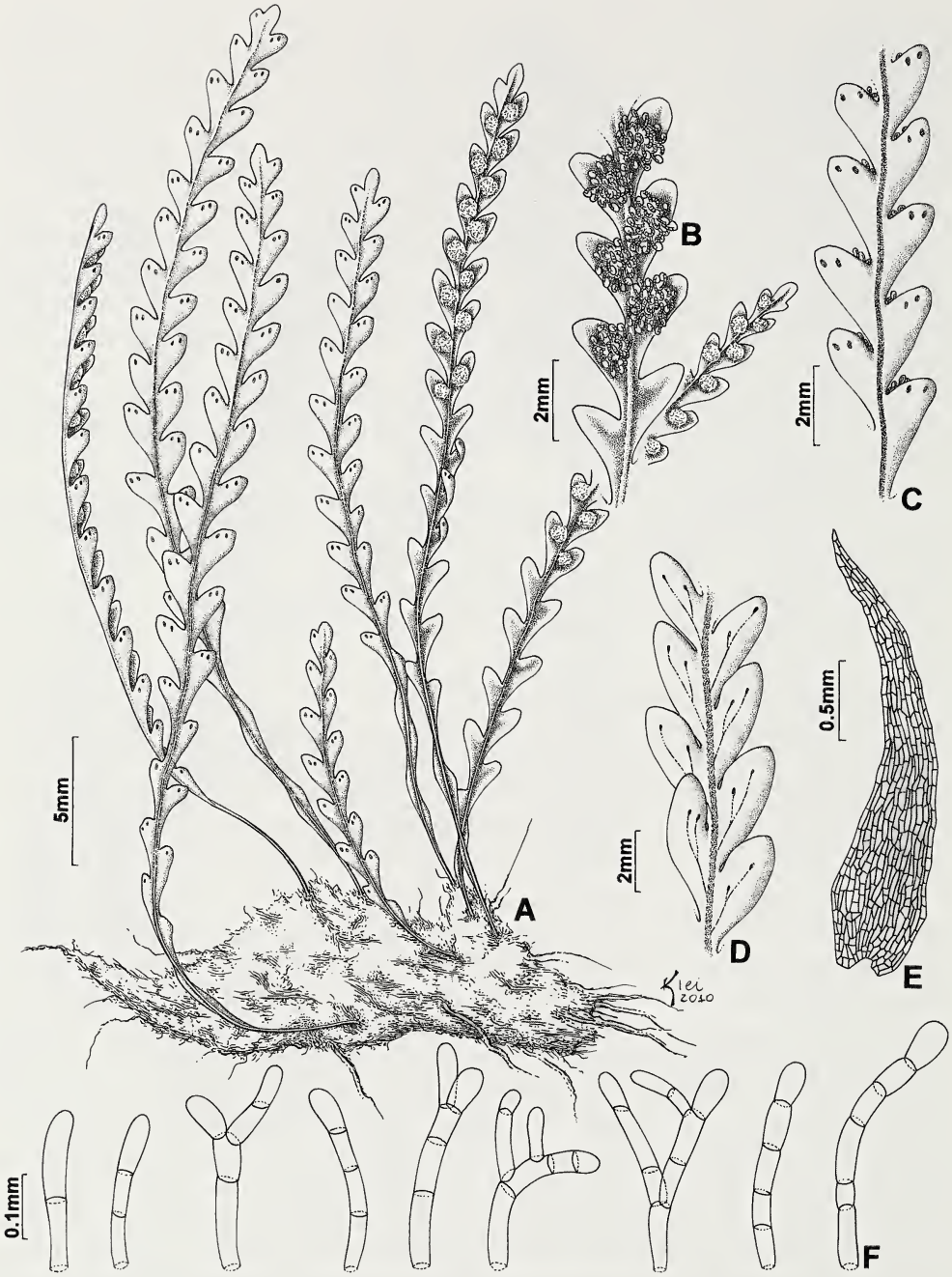

Fig. 27. *Moranopteris perpusilla*. A. Habit. B. Fertile segments showing sori, abaxial view. C. Segments showing hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Unbranched and branched hairs (rehydrated) from costa. A–F: *Hirai 574* (SP).

Distribution.—Endemic to southeastern Brazil (Minas Gerais); 950–1300 m.

Selected Specimens Examined.—BRAZIL. **Minas Gerais**: Catas Altas, RPPN do Caraça, Bocaina, próximo a cachoeira, 1270 m, 20°07′25″S, 43°27′53″W, 2 Jun 2008, *Hirai et al. 574* (NY, SP, SPF, UC); Conceição do Mato Dentro, Parque Natural de Ribeirão do Campo, Cachoeira do Capão Grande, 1250 m, 19°04′53″S, 43°35′22″W, 29 May 2003, *Salino et al. 8718* (BHCB).

Moranopteris perpusilla is endemic to southeastern Brazil. It is easily recognized by rhizome scales with entire margins, pinnatisect laminae, segments diverging at 30–45° to the costae, furcate veins, and two hydathodes per segment (Figs. 27A–E). Moreover, it lacks setae on its leaves.

Labiak and Prado (2005) pointed out that *Micropolypodium perpusillum* (= *Moranopteris perpusilla*) was known only from the type collected by Ule in 1892. After 108 years it was recollected at Conceição do Mato Dentro in Minas Gerais State.

Moranopteris perpusilla seems most closely related to *M. grisebachii*, a Caribbean species. Another similar species, also endemic to southeastern Brazil, is *M. setosa*, which differs in having setose leaves.

18. *Moranopteris plicata* (A. R. Sm.) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Grammitis plicata* A. R. Sm., Ann. Missouri Bot. Gard. 77: 258. 1990. *Micropolypodium plicatum* (A. R. Sm.) A. R. Sm., Novon 2: 422. 1992. TYPE.—VENEZUELA. **Amazonas**: Serranía Parú, Caño Asísa, Río Ventuari, cumbre just south of valley head of Camp Stream, 2000 m, 2 Feb 1951, *R. S. Cowan & J. J. Wurdack 31164* (holotype: UC-1526738; isotypes: NY-148605, US-2291748). **Figs. 23B, 28.**

Plants epiphytic. *Rhizomes* erect with scales 0.6–1.2 × 0.15–0.30 mm, these golden to slightly yellow-brown, ovate-lanceolate to lanceolate, bases slightly cordate, apices acute, rarely with apical or subapical gland-like cells, margins with long, red-brown setiform projections, especially toward the apices, these rarely occurring on scale surfaces, setiform projections, 0.1–0.2 mm long. *Leaves* erect to pendent, determinate, 2.5–7.7(–12.5) cm × 3.0–6.0 mm, moderately to densely setose; *stipes* 0.3–0.9 cm long, dark brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous, sometimes slightly membranaceous; *costae* visible or sometimes weakly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, 45–60° to costae, 10–29 pairs, 0.6–1.0 mm apart, proximal segments 1.0–1.6 mm apart, subopposite, not to rarely gibbous, symmetric, 1.2–2.7 × 0.8–1.4(–1.7) mm, oblong, decurrent, apices rounded to slightly acute, margins plane, sometimes slightly revolute, without hyaline cells, or these sometimes inconspicuous; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, elliptic; *setae* 2.0–3.4 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on stipes, costae, and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, or rarely with branches tinged red-

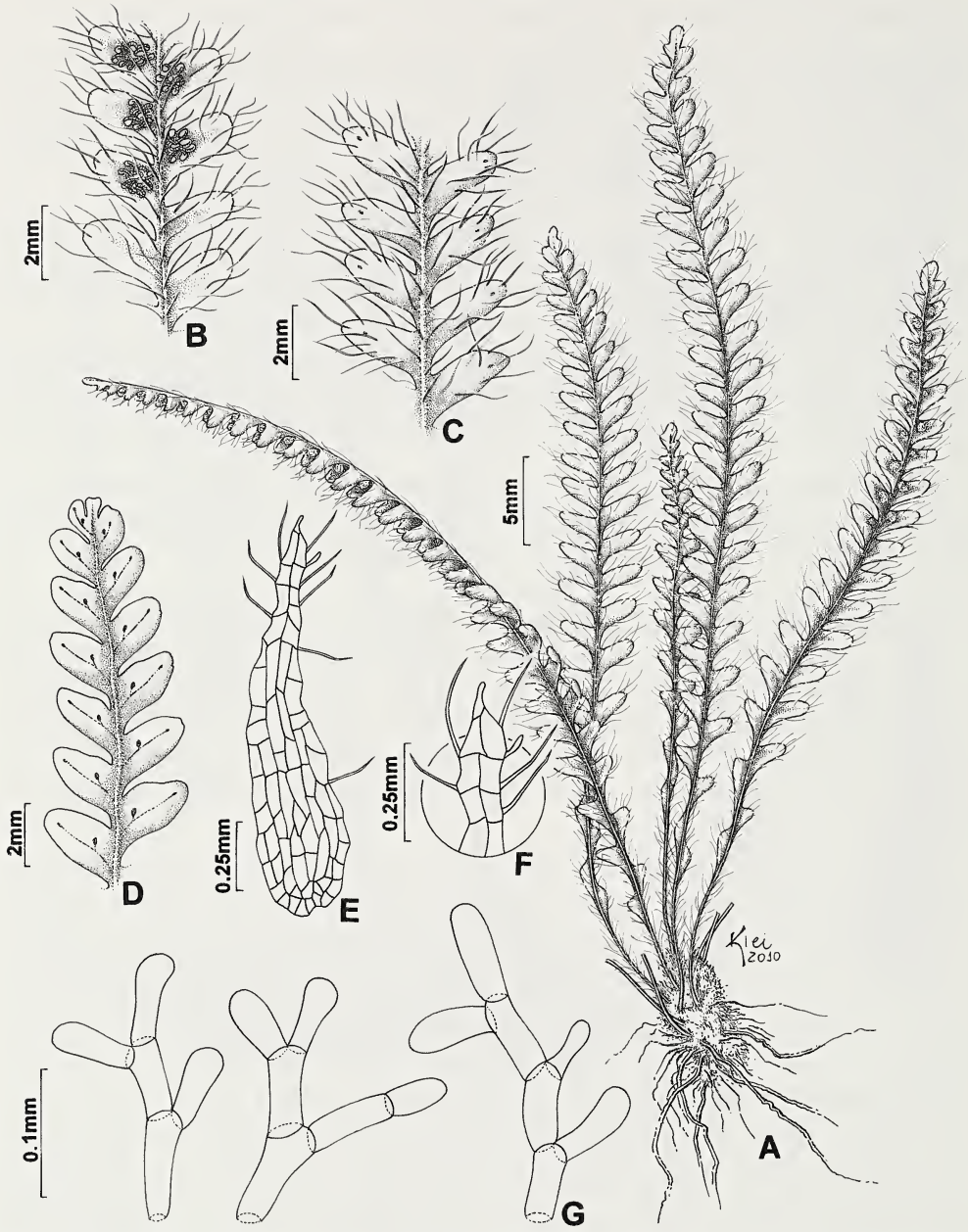

Fig. 28. *Moranopteris plicata*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Detail of apex of rhizome scale. G. Branched hairs (rehydrated) from the costa. A–G: *Maguire & Politi 27990* (NY).

brown, 2- or 3-branched, the main branch 2–4-celled, 0.10–0.25 mm long, 1st branch 1–3-celled, (0.05–)0.10(–0.15) mm long, 2nd branch, if present, 1- or 2-celled, < 0.1 mm long, 3rd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, round, 0.9–1.2 mm diam.

Distribution.—Costa Rica, Venezuela, Colombia, Ecuador, Peru, and Brazil; 900–2600 m.

Selected Specimens Examined.—COSTA RICA. **Cartago**: Pasture and old tree stumps west of Quebrada Casa Blanca, Tapantí, 1350 m, 09°47′N, 83°48′W, 1 Feb 1986, *Smith et al. 2200* (UC).

VENEZUELA. **Amazonas**: Atabapo, slope of Cerro de Marahuaca, Río Yameduaka arriba, 1225 m, 03°38′N, 65°28′W, 19 Feb 1985, *Liesner 17674* (MO, UC); Cerro Sipapo (Paráque), 28 Dec 1948, *Maguire & Politi 27990* (NY, US). **Bolívar**: Heres, Cerro Marutani, cumbre, afloramiento de piedra arenisca en la altiplanicie a lo largo del Río Carla, afluente de las cabeceras del Río Paragua, 1200 m, 03°50′N, 62°15′W, 11–14 Jan 1981, *Steyermark et al. 123952* (NY, MO, RB).

COLOMBIA. **Santander**: Charala, Virolín, 1700 m, Feb 1992, *Tohba & Barbosa 140* (MO). **Chocó**: Hoya del Río San Juan, alrededores de Palestina, 04°10′N, 77°10′W, 26 Mar 1979, *Forero et al. 4053* (MO, US).

ECUADOR. **Zamora-Chinchipe**: Vicinity of mining camp at Río Tundaime, along trail to mining site above camp, 1100–1400 m, 03°34′44″S, 78°24′11″W, 9 Nov 2004, *van der Werff et al. 19433* (MO, NY, UC).

PERU. **Cajamarca**: San Ignacio, San José de Lourdes, Cordillera entre bajo y alto Picorana, 2550–2560 m, 04°59′S, 78°53′W, 7 Dec 1998, *Campos et al. 5970* (MO, UC). **Junín**: Schunke Hacienda, above San Ramón, 1700–1800 m, Aug–Oct 1923, *Schunke A157* (US).

BRAZIL. **Amazonas**: Platô da Serra Aracá, parte SE da Serra Norte, margem da mata de galeria, arredores da pista, 1150–1250 m, 00°51′S, 63°22′W, 18 Feb 1984, *Tavares et al. 85* (NY).

Moranopteris plicata is characterized by having rhizome scales with red-brown long setiform projections on the margins, densely setose leaves, setae 2.0–3.4 mm long, furcate veins, non-gibbous segments, and branched hairs mainly near and on the costae abaxially (Figs. 28A–G).

This species was originally described from a small plant, 3 to 5 mm long, usually with conduplicately folded laminae, and simple veins. After analyses of other specimens from Venezuela we conclude that the species can be larger than the type, to 12.5 cm long, and also with furcate veins and two hydathodes per segment. It seems that the conduplicately folded laminae resulted during the drying of the specimen.

Steyermark et al. 123952 (a paratype) has some segments with furcate veins, two hydathodes per segment, and slightly gibbous segments. This material shows more of the variation of the species. Some specimens, such as *Beitel 85283* (UC), have conspicuously gibbous and non-gibbous segments on the same plant.

Moranopteris nana is the most similar species but has sparsely setose leaves, smaller setae (0.6–1.3 mm long), gibbous segments, and mostly less branched hairs (Figs. 24A–F). Also, *M. nana* occurs often at lower elevations, mostly below 900 m (Fig. 2).

19. *Moranopteris rupicola* R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. TYPE.—GUYANA: Mazaruni-Potaro, Roraima, summit, La Proa Camp, east of border, near Lake Gladys, 2800 m, 05°15′36″N, 60°13′W, 14 Apr 1988, *R. L. Liesner 23289* (holotype: MO-3643239; isotypes: UC-1548464, VEN-258012). **Figs. 25B, 29.**

Plants epipetric. *Rhizomes* erect with scales 2.1–2.7 × 0.3–0.4 mm, these yellow-brown, lanceolate to ligulate, bases slightly cordate, apices acute, mostly with apical or subapical gland-like cells, margins with long setiform projections, or also with small lateral projections, setiform projections rarely occur on the scale surfaces, these red-brown, 0.15–0.30 mm long. *Leaves* erect to arcuate, determinate, 5.5–13.0 cm × 4.5–10.0 mm, sparsely setose; *stipes* 0.5–1.0 cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costae* visible or weakly visible with dark sclerenchyma abaxially, weakly visible with dark sclerenchyma adaxially; *segments* ascending, 60–80° to costae, 17–36 pairs, (0.4–)0.6–1.8 mm apart, subopposite, gibbous, asymmetric, 2.8–4.9 × 1.9–2.9 mm, oblong, decurrent, apices rounded to slightly acute, margins plane, without hyaline cells, or these inconspicuous; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, obovate to oblong; *setae* 1.6–2.4 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on costae and laminar tissue (mainly near costae abaxially), rarely on margins, hyaline or slightly red-brown, branched or rarely unbranched, the branched hairs mostly 1- or 2-branched, the main branch 2- or 3-celled, 0.15–0.25 mm long, 1st branch 1- or 2–celled, (0.05–)0.10(–0.15) mm long, 2nd branch, if present, 1-celled, < 0.1 mm long, the unbranched portion 1-celled, < 0.1 mm long. *Sori* one per segment, round, 1.5–1.8 mm diam.

Distribution.—Guyana and Venezuela, to be expected in northern Brazil; 2350–2800 m.

Specimens Examined.—VENEZUELA. **Bolívar**: Cumbre del Ptari-tepuí, al norte de la Misión de Santa Teresita de Kavanayén, 2360–2420 m, 05°45′N, 61°45′W, 23 Feb 1978, *Steyermark et al. 115650* (GH, UC, VEN).

Moranopteris rupicola has rhizome scales with red-brown, long setiform projections on the margins, sparsely setose leaves, gibbous segments, furcate veins, usually two hydathodes per segment, and mostly branched hairs, these mainly near and on the costae (Figs. 29A–G). *Moranopteris rupicola* resembles *M. taenifolia* in habit and in the position of the hairs mostly near and on the costae abaxially. However, *M. taenifolia* differs in having unbranched hairs and branched hairs with a setiform branch (Fig. 34F).

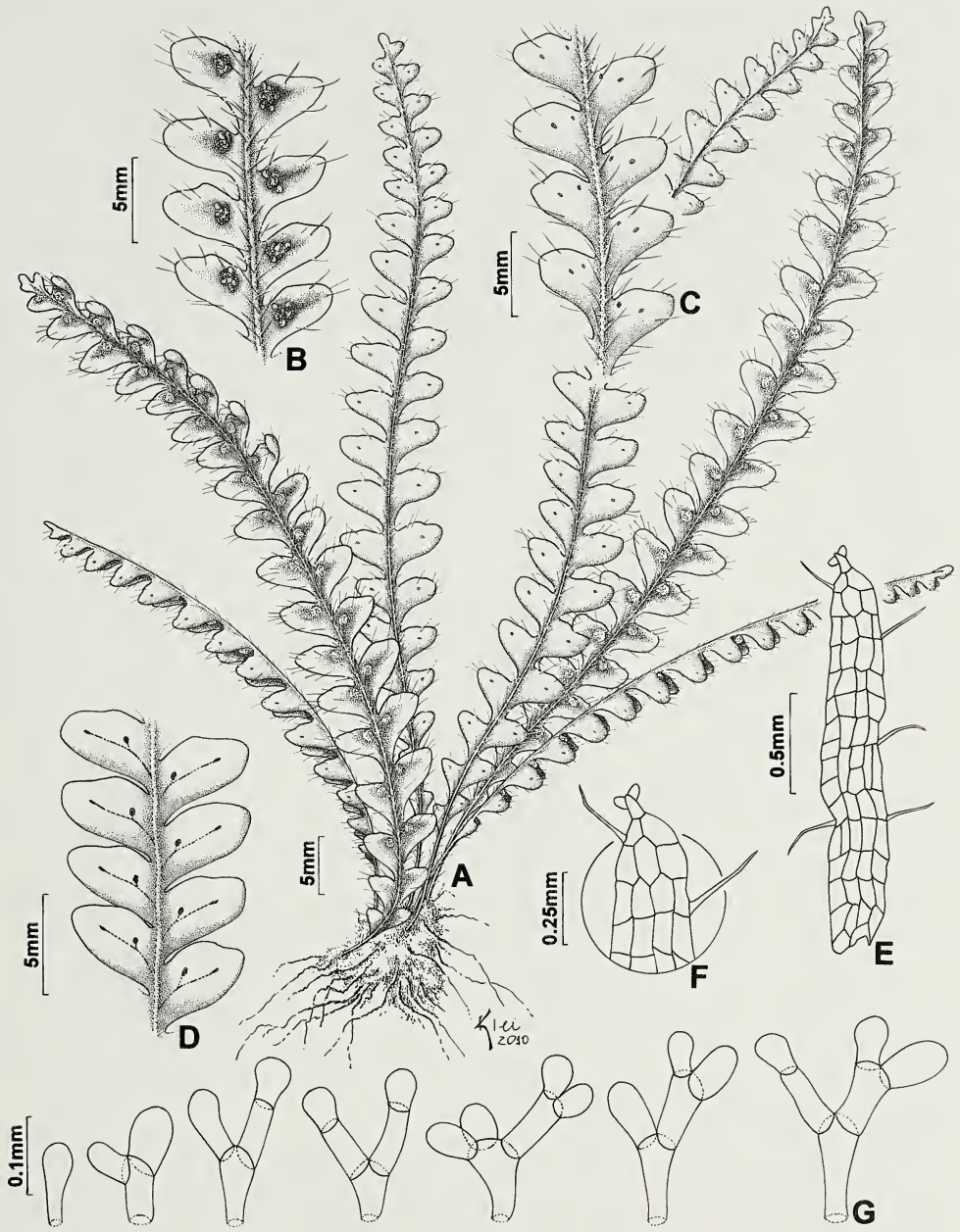

FIG. 29. *Moranopteris rupicola*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Apex of rhizome scale. G. Unbranched and branched hairs (rehydrated) from the costa. A–C, E, F: *Liesner 23289* (MO). D, G: *Steyermark et al. 115650* (UC).

20. *Moranopteris serricula* (Fée) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Polypodium serricula* Fée, Gen. Filic. 238. 1852. *Xiphopteris serricula* (Fée) Copel., Amer. Fern J. 42: 101. 1952. *Grammitis serricula* (Fée) Proctor, Rhodora 63: 35. 1961. *Micropolypodium serricula* (Fée) A. R. Sm., Novon 2: 422. 1992. LECTOTYPE (here designated).—GUADELOUPE. Aux. deux Mamelles, s.d., *G. S. Perrottet s.n.* (B-200149328; isolectotype: RB-216528 p.p.). **Figs. 3O, 25B, 30.**

Plants epiphytic, rarely epipetric. *Rhizomes* erect to decumbent with scales 3.2–3.7 × 0.3–1.0 mm, these yellow-brown to orange-brown, lanceolate, bases subcordate, apices acute, rarely with apical or subapical gland-like cells, margins entire, or with small lateral projections, these rarely furcate. *Leaves* erect to slightly pendent, determinate, 7.5–18.5 cm × 4.0–6.5(–7.0) mm, mostly sparsely setose; *stipes* 1.1–3.5 cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costae* weakly visible with dark sclerenchyma abaxially, or sometimes obscured by laminar tissue, weakly obscured by laminar tissue adaxially; *segments* ascending, 45–60° to costae, 18–63 pairs, 0.6–1.8 mm apart, subopposite, mostly not gibbous, symmetric, 1.8–3.3(–3.9) × 1.1–2.0 (–2.5) mm, deltate, rarely ovate-oblong or oblong, decurrent, apices rounded to slightly acute, margins plane, without hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, elliptic or obovate; *setae* 0.8–2.5(–3.7) mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on costae and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, mostly 2-(3-)branched, the main branch (2-) 3- or 4-celled, 0.1–0.2 mm long, 1st branch 1–3-(4-)celled, < 0.1(–0.2) mm long, 2nd branch 1- or 2-(3-)celled, < 0.1(–0.15) mm long, 3rd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, round, 1.1–1.6 mm diam.

Distribution.—Dominica, Guadeloupe, Martinique, Trinidad and Tobago (restricted to the island of Trinidad), and Venezuela; 700–1950 m.

Selected Specimens Examined.—DOMINICA. **Saint George**: Morne Anglais, 763–1142 m, 3 Aug 1938, *Hodge 53* (NY); Morne Trois Pitons, 1219–1341 m, 29 Jul 1964, *Wilbur et al. 8084* (NY); Summit Morne Trois Pitons, 1400 m, 23 Feb 1940, *Hodge & Hodge 3963* (B, K, L, NY, P, PH, S, UC). **Saint Peter**: Mt. Diablotin, 1903, *Llyod 874* (NY).

GUADELOUPE. Bains Chauds du Matouba, 1000 m, 2 Jan 1937, *Stehlé & Stehlé 1469* p.p. (P); Basse Terre, comm. Basse-Terre/Capesterre, 819–1414 m, 16°03′N, 61°40′W, 6 Mar 2005, *Christenhusz & Katzer 3930* (UC); Chemin Citerne, 1100 m, 2 Feb 1937, *Stehlé 2413* (P); Chemin Lac Flammarion, 1100 m, 15 Aug 1936, *Stehlé 1208* (P); Piste du Carbet, 16 Feb 1936, *Feldman s.n.* (P-637615).

MARTINIQUE. **Saint Pierre**: Calebasse, Morne Paillasse, mont Pelée, 700–1000 m, May 1884, *Duss 1654b* p.p. (NY).

TRINIDAD AND TOBAGO. **Trinidad**: 1896, *Hart 204* (P).

VENEZUELA. **Bolívar**: Below south-east-facing upper shoulder of Apácara-tepuí, between Riscobel Ledema Camp and plateau, 1900–1950 m, 19 Jun 1953, *Steyermark 75704* (NY, US).

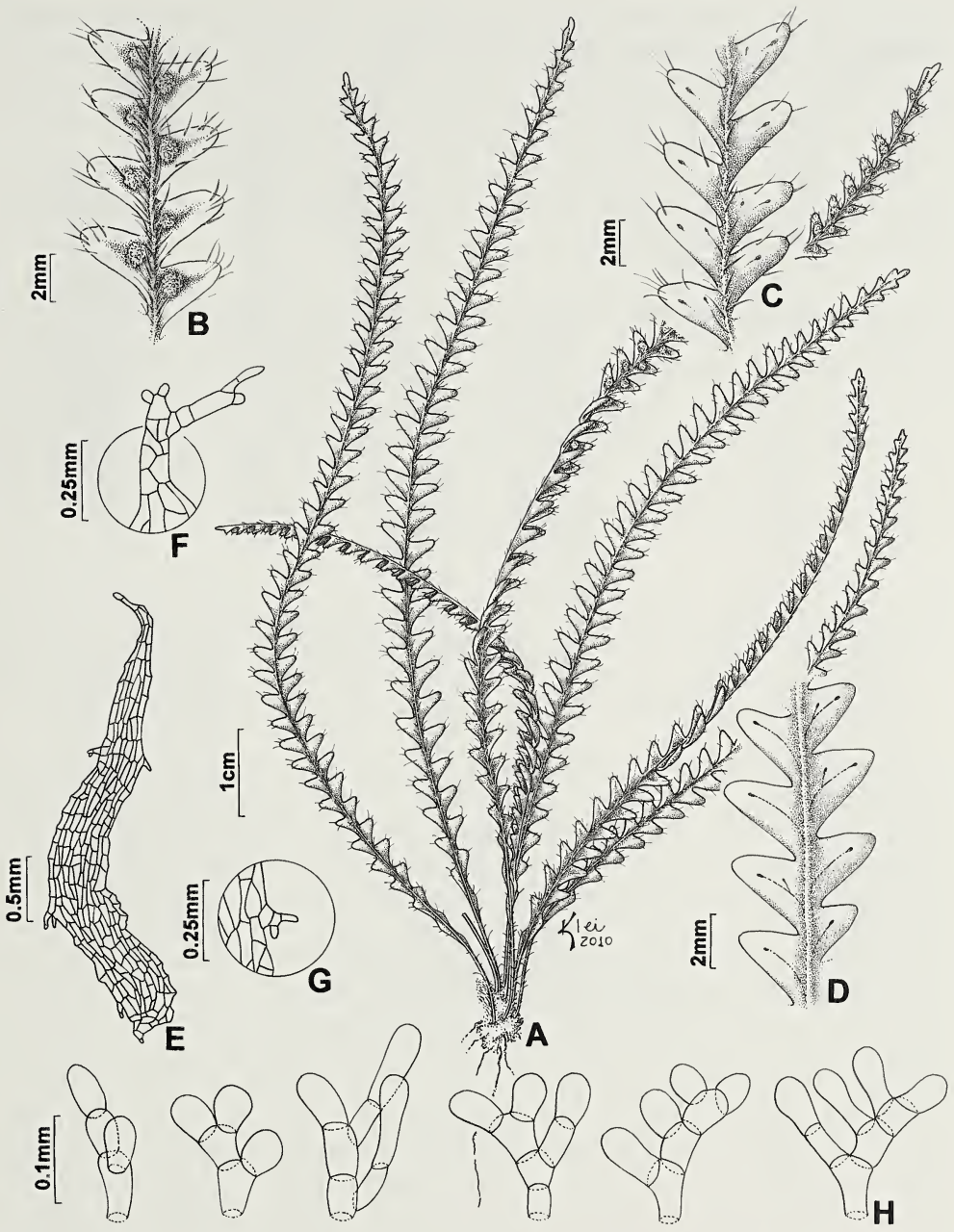

FIG. 30. *Moranopteris serricula*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Apex of rhizome scale. G. Margin of rhizome scale. H. Branched hairs (rehydrated) from costa. A–C: *Duss 1654b* (NY). D, H: *Feldmann s.n.* (P). E–G: *Wilbur et al. 8084* (NY).

Moranopteris serricula is recognized by its rhizome scales with entire margins, ascending deltate segments (40–60° to costae), mostly non-gibbous segments, and two hydathodes per segment (Figs. 30A–E). Specimens from Dominica can have slightly more setose leaves. *Moranopteris knowltoniorum* is the most similar species (see comments under that species).

We choose *Perrottet s.n.* (B) as lectotype for this species. *L'Herminier s.n.* at RB is partly *Stenogrammitis hartii* (Jenman) Labiak (same sheet) as are some of the duplicates of *L'Herminier s.n.* at B and P.

21. *Moranopteris setosa* (Kaulf.) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Xiphopteris setosa* Kaulf., Enum. Filic. 275. 1824. *Grammitis setosa* (Kaulf.) C. Presl, Tent. Pterid. 208. 1836, *nom. illeg.*, *non* Blume (1828). *Polypodium micropteris* C. Chr., Index Filic. 545. 1906, *nom. nov.* for *X. setosa* Kaulf. *Grammitis micropteris* (C. Chr.) Brade, Sellowia 18: 81. 1966. *Micropolypodium setosum* (Kaulf.) A. R. Sm., Novon 2: 422. 1992. TYPE.—BRAZIL. "*Habitat in Brasilia*", s.d., *L. K. A. von Chamisso s.n.* (holotype: probably at B-n.v. or L-n.v.), *ex descr.* **Figs. 5D, 25B, 31.**

Grammitis myosuroides Raddi, Syn. Fil. Bras. 7 (n° 44). 1819, *nom. illeg.*, non Swartz (1801). TYPE.—BRAZIL. **[Rio de Janeiro]:** "Brasilia, Haec et praecedens species inveniuntur in udis rupibus torrentium, super Montes Estrellae, et ambae Musci assimilantur", s.d., *G. Raddi s.n.* (holotype: PI-n.v.), *ex descr.*

Plants epipetric, rarely epiphytic. *Rhizomes* erect to short-creeping with scales 0.9–1.2 × 0.2–0.3 mm, these yellow-brown, ovate, rarely lanceolate, bases slightly cordate, apices acute, margins entire, or rarely with small lateral projections. *Leaves* slightly arcuate, determinate, 2.5–9.0 cm × 1.5–3.0 mm, sparsely setose; *stipes* 0.3–0.9 cm long, yellow-brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costae* weakly visible with dark sclerenchyma abaxially, obscured by laminar tissue adaxially; *segments* ascending, 20–35° to costae, 8–28 pairs, 1.0–1.4 mm apart, alternate, not gibbous, symmetric, 0.5–1.0 × 1.2–2.2 mm, deltate-linear to deltate, decurrent, apices acute to obtuse, margins plane to slightly revolute, without hyaline cells; *veins* furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, elliptic to linear; *setae* 0.5–0.7 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on stipes, costae, and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, branched or rarely unbranched, mostly 2- or 3-(4-)branched, the main branch (2-)3- or 4-(5-)celled, 0.15–0.30 mm long, 1st branch (1-)2- or 3-celled, < 0.1(–0.2) mm long, 2nd branch 1- or 2-celled, < 0.1 mm long, 3rd and 4th branch, if present, 1-celled, < 0.1(–0.15) mm long. *Sori* one per segment, round, 0.7–1.0 mm diam.

Distribution.—Endemic to Coastal Brazil (Espírito Santo, Paraná, Rio de Janeiro, Santa Catarina, and São Paulo States); 100–1950 m.

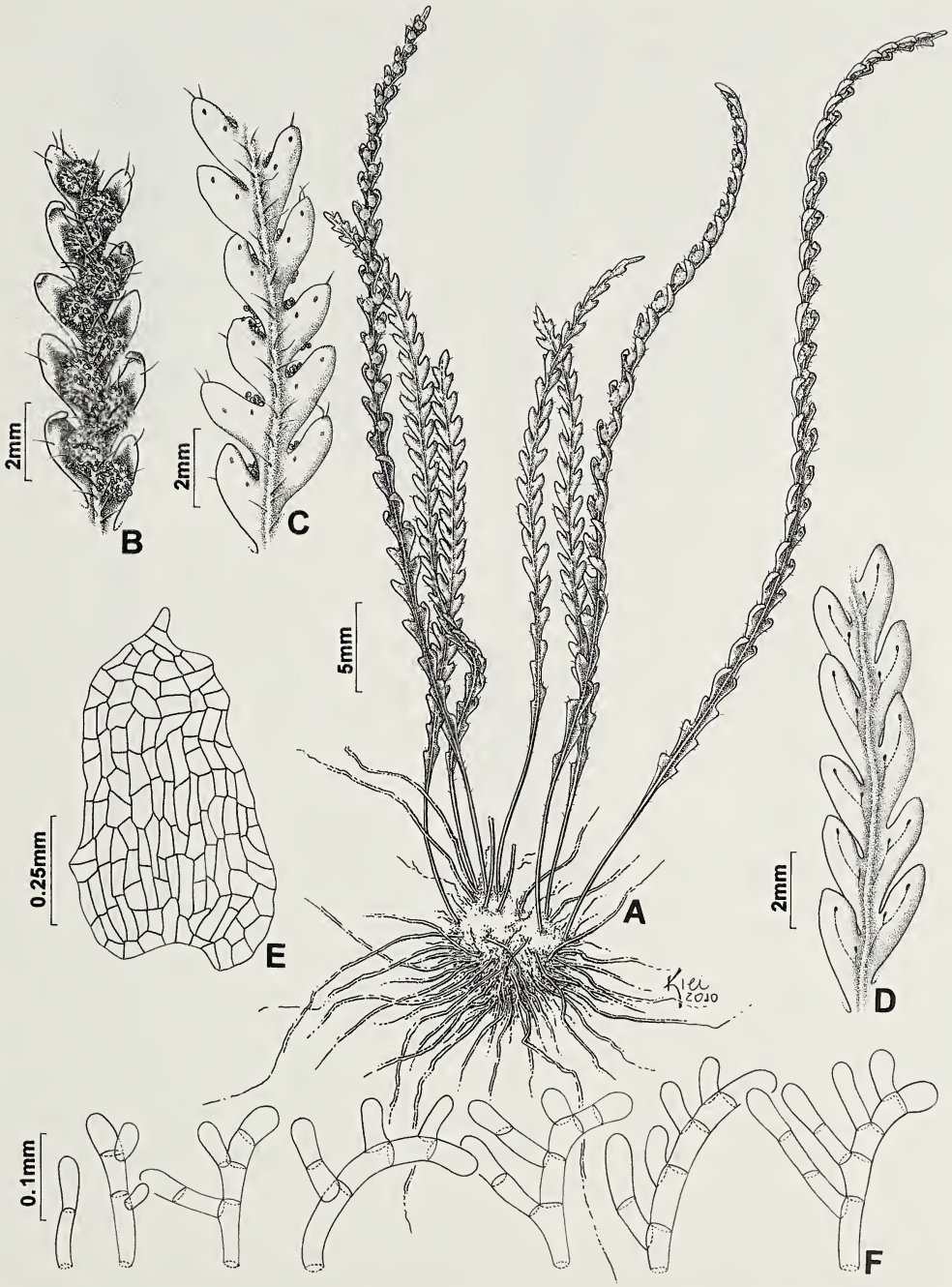

FIG. 31. *Moranopteris setosa*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Unbranched and branched hairs (rehydrated) from costa. A–F: *Hirai et al. 598* (SP).

Selected Specimens Examined.—BRAZIL. **Espírito Santo**: Santa Tereza, Jul 1976, *Barcia 105* p.p. (R). **Paraná**: Antonina, Rio Cotia, 24 Mar 1966, *Hatschbach 14146* (MBM, UPCB). **Rio de Janeiro**: Teresópolis, Parque Nacional da Serra dos Órgãos, Rio Beija-flor, 1100 m, 20 Oct 1977, *Maas & Martinelli 3369* (NY, RB). **Santa Catarina**: Campo Alegre, Morro do Iquererim, 1300 m, 5 Feb 1958, *Reitz & Klein 6421* (HB, MBM, NY). **São Paulo**: Salesópolis, Estação Biológica de Boracéia, Margem do Rio Guaratuba, 800 m, 23°40′S, 45°53′W, 10 Dec 2008, *Hirai et al. 598* (SP, TAIF, VT).

Moranopteris setosa can be distinguished from other species by having segments ascending, 20–35° to the costae (Figs. 31A–D). It resembles *M. perpusilla*. Both species are endemic to Brazil and have similar leaves. *Moranopteris perpusilla* differs in having costae obscured by laminar tissue adaxially and setae absent from the leaves (Labiak and Prado, 2005) (Figs. 27A–D). Also, *M. perpusilla* mostly has lanceolate rhizome scales (vs. ovate scales in *M. setosa*, Fig. 27E).

22. *Moranopteris sherringii* (Baker) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Polypodium sherringii* Baker, J. Bot. 20: 26. 1882. *Xiphopteris sherringii* (Baker) Copel., Amer. Fern J. 42: 104. 1952. *Grammitis sherringii* (Baker) Proctor, Bull. Inst. Jamaica, Sci. Ser. 5: 35. 1953. *Micropolypodium sherringii* (Baker) A. R. Sm., Novon 2: 423. 1992. LECTOTYPE (designated by Proctor, 1985).—JAMAICA. **Newton District**: Port Royal Mountains, 1219–1371 m, 1873–1874, *R. V. Sherring s.n.* (K-575412; isolectotypes: NY-127080; frag. NY-127079). **Figs. 7B, 32.**

Plants epiphytic or epipetric. *Rhizomes* erect with scales 1.6–3.1 × 0.3–0.5 mm, these golden to yellow-brown, lanceolate, bases narrowly cordate, apices acute, rarely with an apical or subapical gland-like cell, margins entire, or rarely with small lateral projections. *Leaves* erect to arcuate, determinate, 3.5–4.5 cm × 4.0–5.0 mm, sparsely setose; *stipes* almost absent; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous, sometimes slightly membranaceous; *costae* weakly visible with dark sclerenchyma mainly at bases, weakly obscured by laminar tissue abaxially and adaxially; *segments* ascending, 50–60° to costae, 6–14 pairs, 0.6–1.1 mm apart, subopposite, not gibbous, symmetric, 2.1–2.5 × 1.5–1.8 mm, oblong to deltate, decurrent, apices rounded, margins plane, without or rarely with hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, elliptic to linear, or obovate; *setae* 0.6–1.2 mm long, dark red-brown, on all sides of costae and laminar tissue, rarely on margins; *hairs* present on costae and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, or sometimes with branches tinged red-brown, mostly (1-)2- or 3-branched, the main branch (2-)3- or 4-(5-)celled, 0.15–0.25 mm long, 1st branch 1- or 2-celled, < 0.1(–0.2) mm long, 2nd branch 1- or 2-celled, < 0.1(–0.15) mm long, 3rd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, round, 1.0–1.4 mm diam.

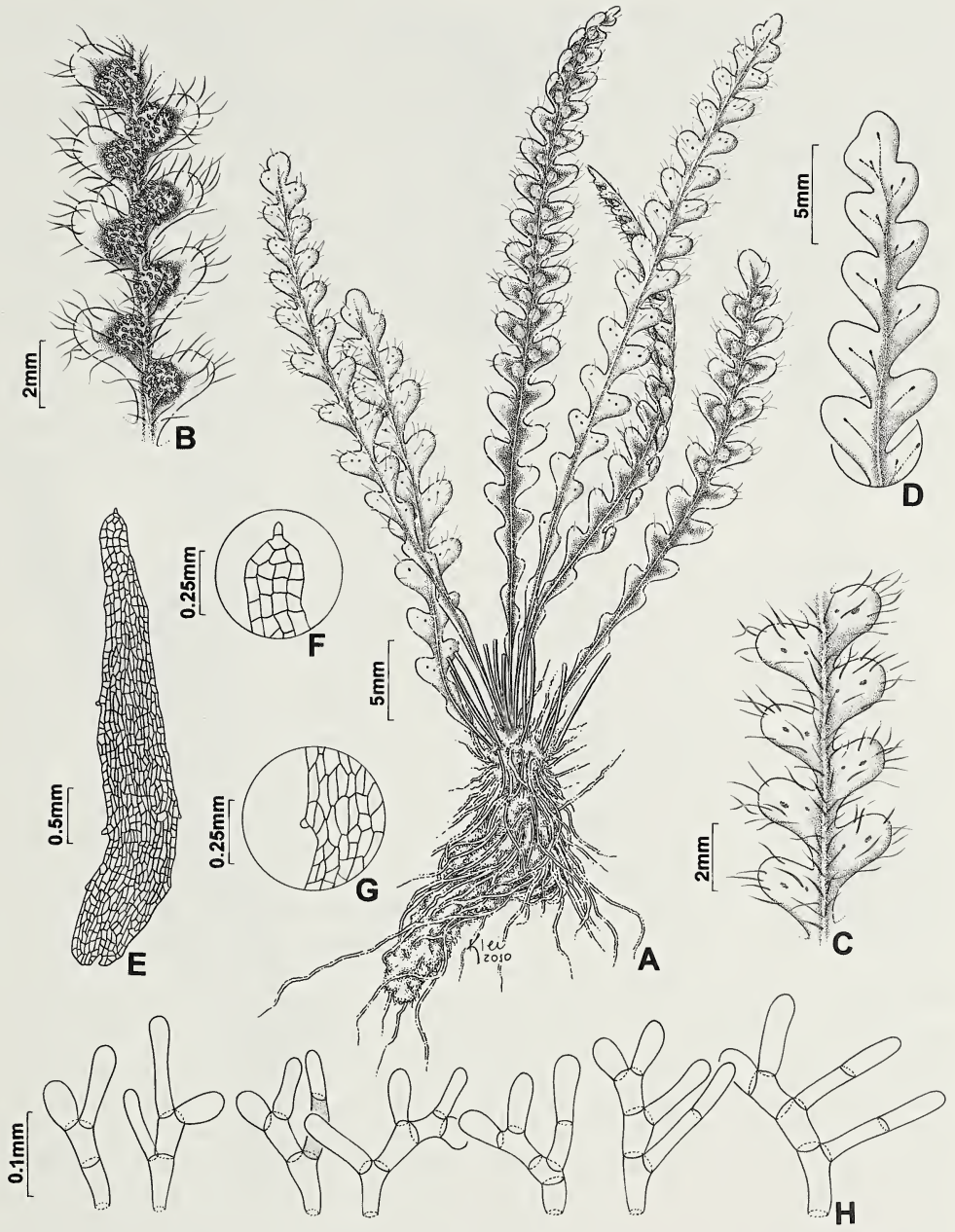

FIG. 32. *Moranopteris sherringii*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Apex of rhizome scale. G. Margin of rhizome scale. H. Branched hairs (rehydrated) from costa. A–H: *Ekman 5209a* (S).

Distribution.—Endemic to the Greater Antilles (Cuba, Jamaica, and according to Proctor (1989) in Puerto Rico); 1200–1400 m.

Selected Specimens Examined.—CUBA. Oriente, Sierra Maestra, Punta de Palmamocha, 1400 m, 5 Apr 1915, *Ekman 5209a* (S); Pico Turquino, Jul 1922, *Leon 11115* (NY).

JAMAICA. Mar 1885, *Jenman 10* (P, frag. K).

Fronds of *Moranopteris sherringii* are small, ca. 4.5 cm long, the leaves sparsely setose, and the rhizome scales have entire margins. Segments are non-gibbous, with furcate veins and two hydathodes per segment (Figs. 32A–D).

Proctor (1985) and other authors have pointed out that this species is very rare. All material analyzed in this study was collected between 1873–1922.

Young plants of *Moranopteris basiattenuata* can sometimes be confused with *M. sherringii*, but differ by having 1-branched hairs with the first branch at least twice as long as the main branch. Additionally, fronds of *M. basiattenuata* are moderately to densely setose (vs. sparsely setose in *M. sherringii*).

23. *Moranopteris simplex* R. Y. Hirai & J. Prado, Taxon 60: 1135. 2011. TYPE.—VENEZUELA. **Aragua**: Maracay, Choroní-Passes, 1600 m, 28 Feb 1958, *K. Mägdefrau 464* (holotype: B-200077185). **Figs. 25B, 33.**

Plants epiphytic. *Rhizomes* erect with scales 2.0–2.2 × 0.20–0.25 mm, these yellow-brown, lanceolate to linear-lanceolate, bases slightly cordate, apices acute, with apical or subapical gland-like cells, margins entire or with small, simple or furcate lateral projections. *Leaves* erect to arcuate, determinate, 3.5–7.6 cm × 5.0–7.5 mm, moderately setose; *stipes* nearly absent, brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, rarely deeply pinnatifid, gradually tapering proximally to a narrow wing, chartaceous; *costae* obscured by laminar tissue abaxially and adaxially, sometimes weakly visible with dark sclerenchyma abaxially; *segments* ascending, 60–80° to costae, 18–35 pairs, 1.1–1.7 mm apart, subopposite, gibbous, asymmetric, 2.5–3.8 × 1.1–1.6 mm, oblong to oblong-lanceolate, deltate toward laminae bases, decurrent, apices rounded to slightly acute, margins slightly revolute, without hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2(3) hydathodes per segment, elliptic to obovate, sometimes round; *setae* 1.1–2.7 mm long, dark red-brown, on all sides of costae and laminar tissue; *hairs* scattered all along costae, laminar tissue abaxially, and margins, hairs hyaline to yellowish or slightly red-brown, unbranched and branched, the unbranched hairs 2-celled, 0.05–0.15 mm long, the branched hairs 1-(2-) branched, the main branch 2- or 3-celled, (0.05–)0.1(–0.2) mm long, 1st branch 1- or 2-celled, 0.10–0.15 mm long, 2nd branch, if present, 1-celled, (0.05–) 0.1 mm long. *Sori* one per segment, round or nearly so, 1.4–1.8 mm diam.

Distribution.—Endemic to Venezuela; 1600–1950 m.

Selected Specimens Examined.—VENEZUELA. **Aragua**: Colonia Tovar, s.d., *Moritz s.n.* p.p. (P-637667, P-696244). **Distrito Federal**: Caracas, Monte Grappa,

FIG. 33. *Moranopteris simplex*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Unbranched and branched hairs (rehydrated) from costa. A–C, E: *Mägdefrau 464* (B). D, F: *Quijada 4* (VEN).

18 Aug 1985, *Quijada 4* (VEN); El Junquito, 1925 m, 26 Mar 1943, *Killip & Rohl 37170* (US).

Moranopteris simplex is easily distinguished by its hairs which are mostly yellowish, unbranched and 1-branched and which are scattered all along costae and on the laminar tissue abaxially (Fig. 33F).

The most similar species is *Moranopteris trichomanoides*, which occurs in the Greater Antilles and Central America. It differs by having mostly 2–4-branched hairs (Fig. 36G) near and on the costae abaxially; unbranched hairs are absent.

24. *Moranopteris taenifolia* (Jenman) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Polypodium taenifolium* Jenman, Bull. Bot. Dept. Jamaica, n.s. 4: 114. 1897. *Xiphopteris taenifolia* (Jenman) Copel., Amer. Fern J. 42: 109. 1952. *Grammitis taenifolia* (Jenman) Proctor, Bull. Inst. Jamaica, Sci. Ser. 5: 35. 1953. *Micropolypodium taenifolium* (Jenman) A. R. Sm., Novon 2: 423. 1992. LECTOTYPE (designated by Proctor, 1985).—JAMAICA. **Saint Andrew**: Monte Moses, near Mt. Moses, s.d., *G. Syme s.n.* p.p. (J.P. 197) (IJ-n.v.), *ex descr.* **Figs. 4C, D, 34, 35A.**

Polypodium daguense Hieron., Bot. Jahrb. Syst. 34: 504. 1904. *Xiphopteris daguensis* (Hieron.) Copel., Amer. Fern J. 42: 107. 1952. *Grammitis daguensis* (Hieron.) C. V. Morton, Contr. U.S. Natl. Herb. 38: 98. 1967. TYPE.—COLOMBIA. **Cauca**: Río Dagua, 20 Sep 1882, *F. C. Lehmann 1951* (holotype: B-200091630; photo US-692650).

Polypodium sintenisii Hieron., Hedwigia 44: 101. 1905. LECTOTYPE (here designated).—PUERTO RICO. Without exact locality, Jul 1885, *P. Sintenis 1796* (B-200150131; isolectotypes: B-200150130 p.p.; M-151279, frag. NY-127081 p.p., P-632719, P-696185, P-637692, P-637691, S-08-21047, US-833633).

Polypodium blepharolepis C. Chr., Index Filic., Suppl. 1: 58. 1913. *Polypodium gracillimum* Hieron., Hedwigia 48: 250, t. 12, f. 18. 1909, *nom. illeg.*, *non* Copeland (1905). *Xiphopteris blepharolepis* (C. Chr.) Copel., Amer. Fern J. 42: 109. 1952. *Grammitis blepharolepis* (C. Chr.) C. V. Morton, Contr. U.S. Natl. Herb. 38: 98. 1967. TYPE.—ECUADOR. "Excursiva von Quito norh Mindo", s.d., *M. A. Stübel 747* (holotype: B-200149304).

Polypodium blepharodes Maxon, Contr. U.S. Natl. Herb. 17: 407. 1914. *Xiphopteris blepharodes* (Maxon) Copel., Amer. Fern J. 42: 109. 1952. *Grammitis blepharodes* (Maxon) F. Seym., Phytologia 31: 173. 1975. TYPE.—COSTA RICA. Vicinity of La Palma, 1450–1550 m, 6–8 May 1906, *W. R. Maxon 406* (holotype: US-575795; isotype: NY-144938).

Plants epiphytic. *Rhizomes* erect with scales 0.7–2.1 × (0.2–)0.3–0.6 mm, these golden to slightly yellow-brown, mostly tinged red-brown on distal third,

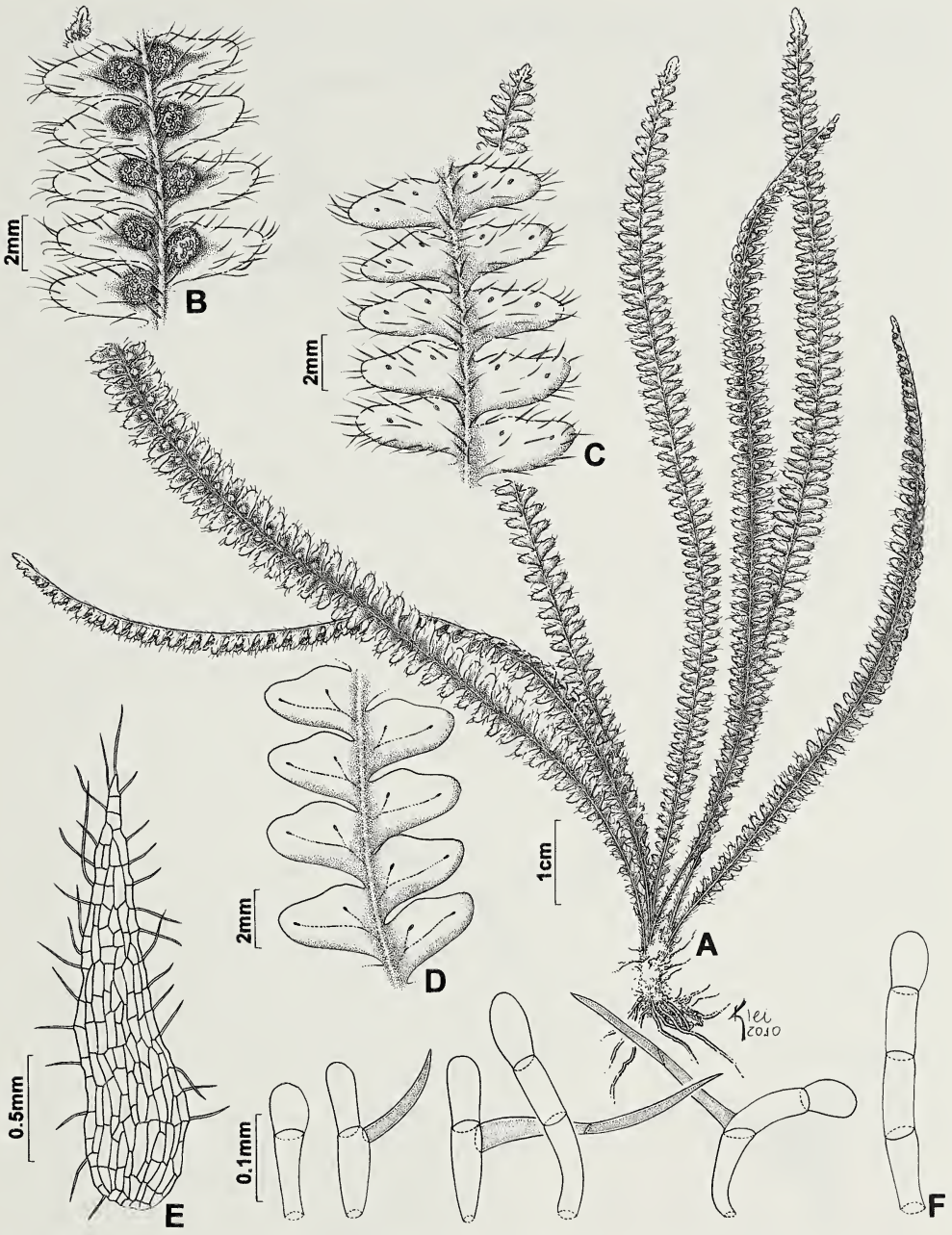

FIG. 34. *Moranopteris taenifolia*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Unbranched and branched hairs with one setiform branch (rehydrated) from costa. A–C, E: *Axelrod et al. 408* (UPRRP). D, F: *Granville 3557* (CAY).

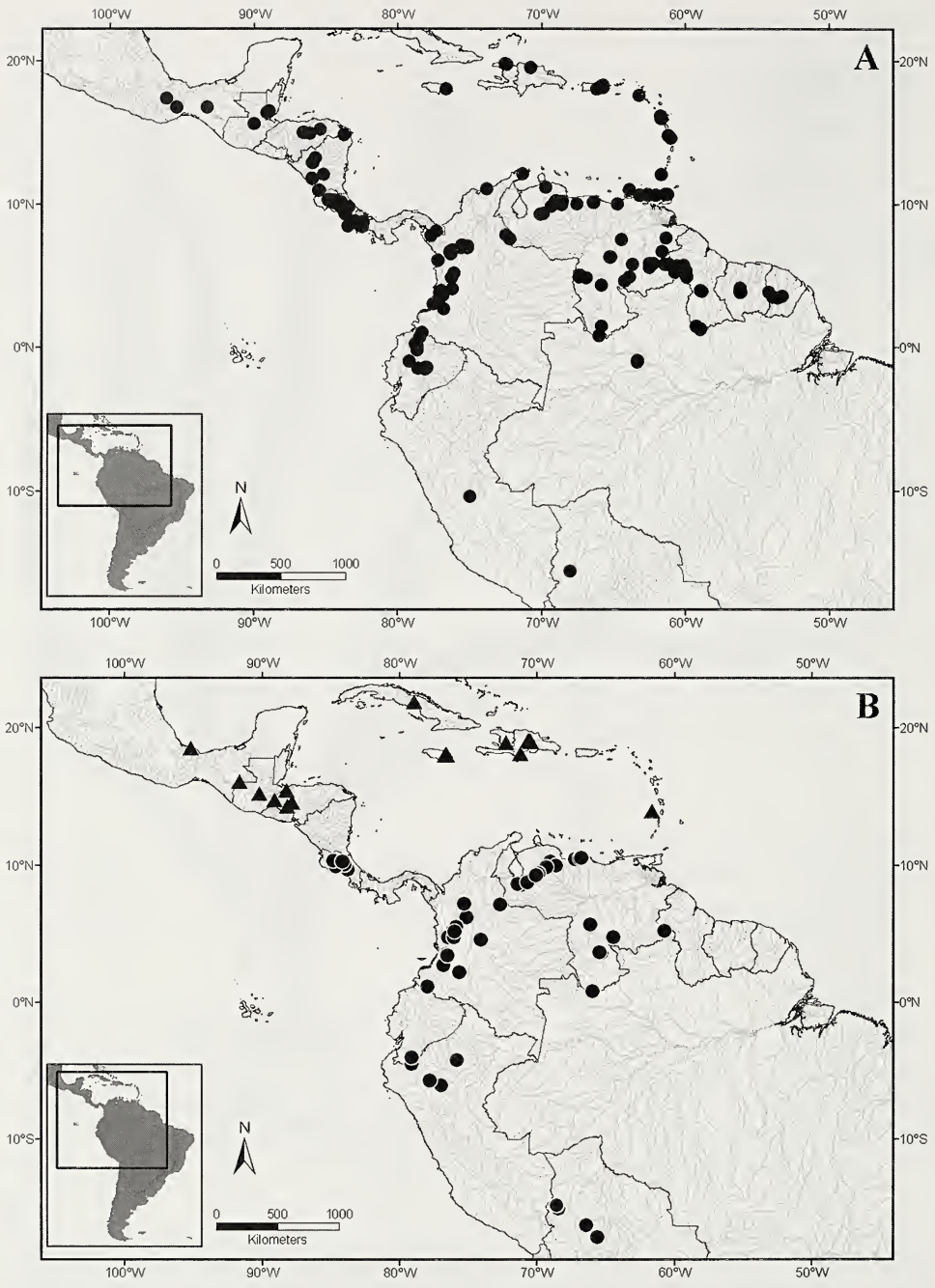

FIG. 35. A. Distribution of *Moranopteris taenifolia* (●). B. Distributions of *M. trichomanoides* (▲) and *M. truncicola* (●).

ovate-lanceolate to lanceolate, bases cordate to slightly truncate, apices acute, margins with long setiform projections, these red-brown, 0.15–0.30 mm long. *Leaves* erect to pendent, determinate, 5.0–15.0(–36.0) cm × (2–)4–9 mm, moderately setose; *stipes* (0.4–)1.1–2.0 cm long, yellow-brown to dark brown, wings absent; *laminae* linear, pinnatisect, rarely pinnate at bases, gradually tapering proximally, chartaceous; *costae* visible with dark sclerenchyma abaxially, obscured by laminar tissue or sometimes weakly visible with dark sclerenchyma adaxially; *segments* patent, 80–90° to costae, 38–62(–110) pairs, 0.4–1.0 mm apart, alternate to subopposite, gibbous, asymmetric, (1.3–)2.3–3.9(–4.9) × (0.7–)1.0–1.9(–2.7) mm, oblong to lanceolate, slightly decurrent, apices acute to rounded, margins plane to slightly revolute, without hyaline cells or these inconspicuous; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2 hydathodes per segment, oblong to obovate; *setae* 0.3–1.1(–1.4) mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on stipes, costae, and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, unbranched and branched, branched hairs with 1 or 2 setiform branches, unbranched hairs mostly 2–4-celled, 0.10–0.25(–0.35) mm long, branched hairs 1- or 2-branched, the main branch 2- or 3-celled, 0.10–0.15(–0.20) mm long, 1st branch setiform, (0.15–)0.2–0.5 mm long, 2nd branch, if present, with setiform branch, (0.15–)0.2–0.3 mm long. *Sori* one per segment, round, 0.7–1.7 mm diam.

Distribution.—Mexico, Belize, Guatemala, Honduras, Nicaragua, Costa Rica, Panama, Jamaica, Haiti, Dominican Republic, Puerto Rico, Saint Kitts and Nevis, Guadeloupe, Martinique, Trinidad and Tobago (restricted to the island of Trinidad), French Guiana, Suriname, Guyana, Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil; 30–2650 m.

Selected Specimens Examined.—MEXICO. **Chiapas**: Berriozábal, 13 km north of Berriozábal near Pozo Turipache and Finca El Suspiro, 900 m, 25 Dec 1972, *Breedlove 30809* (NY). **Oaxaca**: Tehuantepec, between La Chiguzhé and Guevea de Humboldt, 1219–1371 m, 25 Jul 1972, *Hallberg 1728* (NY).

BELIZE. **Toledo**: Along divide of Maya Mountains, Bladen Nature Reserve, 950–1000 m, 16°31′N, 88°57′W, 12 May 1996, *Holst et al. 5248* (UC).

GUATEMALA. **Alta Verapaz**: Near Chirriacté, on the Petén highway, 900 m, 9 Apr 1941, *Standley 91702* (UC).

HONDURAS. **Olancho**: Along Río Olancho, on road between San Francisco de la Paz and Gualaco, 13.6 mi SW of Gualaco, 1300 m, 15°00′N, 86°07′W, 6 Feb 1987, *Croat & Hannon 64276* (UC).

NICARAGUA. **Granada**: On Mombacho Volcano, 1300 m, 5 Jan 1967, *Williams & Molina 20007* (NY). **Jinotega**: Macizos de Peñas Blancas, top and N slope of steep ridge SW of finca of Manuel Estrada (El Cielo), S of Río Gusaneras, 1200–1330 m, 13°15′N, 85°42′W, 16 Jan 1979, *Stevens & Krukoff 11523*, p.p. (UC). **Matagalpa**: Disparate de Potter, Sta. María de Ostuma, Cordillera Central de Nicaragua, 1600 m, 15 Jan 1965, *Williams et al. 27621* (NY).

COSTA RICA. **Alajuela**: Volcán Poas summit area and lake, 2500–2650 m, 6 Jul 1967, *Bishop 805* (UC). **Cartago**: ca. 22 km E of Turriaba, high ridge above

Platanillo, 1200–1450 m, 22 Aug 1967, *Mickel 3396* (LP, NY, UC). **Guanacaste**: Guanacaste National Park, Estación Biológica Pitilla, 7 km SE de Santa Cecilia, east slope of Volcán Orosí, 800 m, 11°00′N, 85°30′W, 8 May 1992, *Moran & Moran 5819* (NY, UC). **Heredia**: P. N. Braulio Carrillo, entrada Quebrada Gonzales, 513 m, 10°N, 84°W, 23 Jan 2008, *Sundue 1653* (NY). **Limón**: Cantón de Pococí, Cordillera Central, forests mainly to the E of main E branch of Quebrada El Molinete, 480–520 m, 10°10′25″N, 83°55′10″W, 24 Jul 1994, *Grayum & Perry 10675* (UC). **Puntarenas**: Cantón de Golfinho, P. N. Corcovado, Península de Osa, Cerro Rincón, Nacientes del Río Tigre, 700–745 m, 08°31′N, 83°28′W, 28 Jan 1998, *Rojas et al. 4195* (NY). **San José**: Along unnamed north fork of Río Zurquí, upstrean from highway, north of tunnel, Cordillera Central, 1500–1600 m, 10°04′N, 84°01′W, 18 Jan 1986, *Smith et al. 1649* (UC).

PANAMA. **Chiriquí**: Along trail between north fork of Río Palo Alto and Cerro Pate Macho, ca. 6 km NE of Boquete, 1600–2000 m, 08°48′N, 82°23′W, 6 Feb 1986, *Smith et al. 2417* (UC). **Darién**: Along ridge trail from Cana up the Cerro Pirre Massif, 1000–1300 m, 07°50′N, 77°40′W, 3 May 1990, *Moran 5065* (UC).

JAMAICA. **Portland**: On middle western slopes of Crown Peak, John Crow Mts., 838 m, 27 May 1950, *Proctor 4586* (PH).

HAITI. Massif du Nord, Bayeux, Morne Brigarest, on top of the mountain, 900–1150 m, 20–21 Dec 1924, *Ekman 2982a* (S).

DOMINICAN REPUBLIC. **Santo Domingo**. Santiago, Cordillera Septentrional, Loma Diego de Ocampo, 1200 m, 4 Dec 1930, *Ekman 16311* (NY, S).

PUERTO RICO. Bosque Nacional Luquillo, cumbre de Monte Britton, 900 m, Sep-Oct 1966, *Byer 66-1008* (UPRRP); Rio Grande Caribbean National Forest, trail to El Toro Peak, 700–850 m, 8 Feb 1986, *Axelrod et al. 408* (UPRRP).

SAINT KITTS AND NEVIS. **Saint Kitts**: Slopes Mt. Misery, 8 Sep–5 Oct 1901, *Britton & Cowell 515* p.p. (NY).

GUADELOUPE. Bains Jaunes entre Ajoupa et Savane à Mulets, 1 Jan 1937, *Stehlé & Stehlé 1470* p.p. (P); Basse Terre, comm. Petit-Bourg-Bouillante, Parc National de la Guadeloupe, route de la Traversée D23, Trace de Mamelle de Pigeon ou Déboulé, 615–768 m, 16°11′N, 61°44′W, 22 Mar 2005, *Christenhusz 4214* (UC).

MARTINIQUE. Montagne Pelée, morne Paillasse, 600–1000 m, 1884, *Duss 1554* (NY).

TRINIDAD AND TOBAGO. **Trinidad**: Heights of Aripo, 10–26 Jan 1922, *Broadway 9954* (NY, US).

FRENCH GUIANA. Mont Atachi Bacca-Région de l'Inini, plateau sommitale, 650 m, 03°33′N, 53°55′W, 16 Jan 1989, *Cremers et al. 10248* (CAY, NY, P); Sommet Tabulaire, ± 50 km SE de Saül, 750 m, 22 Aug 1980, *Granville 3557* p.p. (CAY, K).

SURINAME. **Sipaliwini**: East ridge overlook (Tafelberg), trail around the east ridge overlook of the Tafelberg, 990 m, 03°53′05″N, 56°08′28″W, 2 Jul 2001, *Hawkins 2111* (MO, NY, US).

GUYANA. **Cuyuni-Mazaruni**: Monte Roraima, NW facing slopes of Mt. Roraima, vicinity of Camp 6, near the end of the "Waruma Trail", 1280–

1310 m, 05°16′30″N, 60°44′45″W, 23 Mar 1978, *Warrington et al. K.E.R. 9* (NY). **Potaro-Siparuni**: Pakaraima Mts, Mt. Kukuinang, 2–3 km SSW from mountain peak, 950–1050 m, 05°04′N, 59°57′W, 27 Feb 1993, *Henkel et al. 1628* (US). **U. Takutu-U. Essequibo:** Makarapan Mt., southern false summit, 870 m, 03°57′55″N, 58°51′58″W, 29 Sep 1997, *Clarke et al. 6881* (CAY, NY, US).

VENEZUELA. **Amazonas**: Atures, Caño Piedra, 115 km al SE de Puerto Ayacucho, 1500 m, 04°54′N, 66°54′W, Sep 1989, *Sanoja et al. 2960* (UC). **Aragua**: El Portachuelo, between Ocumare and Maracay, 8 May 1925, *Pittier 11821* (US). **Bolívar**: Cedeno, Serranía de Maigualida, 20 km al E de San José de Kayamá, 45 km al N de Cerro Impacto, 1250 m, 06°19′N, 65°12′W, Apr 1989, *Fernandez 5435* (MO, UC). **Falcón**: Sierra de San Luis, arriba de Sta Maria, 1200 m, 6 May 1979, *van der Werff 3492* (UC). **Lara**: Palavecino, road to Parque Nacional Terepaima, riecito, ca. 9 km SE of town of Río Claro, near summit of road, 1600 m, 09°53′N, 69°19′W, 14 Nov 1982, *Smith et al. 1278*, p.p. (MO, UC). **Miranda**: Paéz, Fila La Tigra, Qdo. San Juan, 18 km al SO de Cúpira, 10°04′N, 64°45′W, 2–7 Sep 1977, *Ortega & González 399* (MO, UC). **Monagas**: Caripe, Cordillera de la Costa, 10 km al este de Caripe (distancia aérea), Quebrada Grande, propriedad de Rolf Struppek, 1250–1350 m, 10°10′30″N, 66°24′W, 28 Feb 2006, *Meier & Struppek 13478* (UC). **Nueva Esparta**: Isla de Margarita, Cerro Copey, south of Santa Ana, 800–850 m, 11°02′N, 63°55′W, 24 Mar 1985, *Steyermark et al. 131054* (UC). **Portuguesa**: Guanare, ESE of Paraíso de Chabasquén, along road to Cordoba, ca. 27 min. from Chabasquén, just below summit and below road, 1500 m, 09°23′N, 69°54′W, 7 Nov 1982, *Smith et al. 1100* (UC). **Sucre**: Arismendi, Peninsula de Paria, between Tacarigua and headwaters of Río Tacarigua, east of Cerro Humo, N of Río Grande Arriba, 700–900 m, 10°41′N, 62°36′W, 23 Feb 1980, *Steyermark et al. 121633* (MO, NY, UC). **Táchira**: Cerro Azul at Cerro Las Minas, 18 km southeast of Santa Ana, 1200–1380 m, 07°36′N, 72°13′W, 11 Nov 1979, *Steyermark et al. 120024* (MO, UC). **Yaracuy**: Urachiche, Monumento Natural María Lionza, Cordillera de la Costa, al sur de Chivacoa, subida Quebrada Quibayo-La Fortaleza-Tres Casitas, entre Tres Casitas y 1000 m, 780–1000 m, 10°06′N, 68°55′W, 26 Mar 2004, *Meier et al. 10334* (UC).

COLOMBIA. **Antioquia**: Anorí, Reserva la Forzosa, 1815 m, 06°59′15″N, 75°08′35″W, 27 Sep 2003, *Rodríguez et al. 4003* (NY). **Cauca**: Río San Juan de Micay, 60 m, 21 Dec 1946, *Haught 5364* (S, US). **Chocó**: Cerro Tacarcuna, to the Serrania del Darien, Cerro Mali, on border with Panama, 1200–1400 m, 17 Jan 1975, *Gentry & Mori 13697* (MO). **Magdalena**: Alto Río Buritaca, Alto de Mira, por el camino hasta el pico de 1500 m, 1100–1500 m, 11°05′N, 73°48′W, 16 Jul 1989, *Madriñán & Barbosa 328* (GH). **North Santander:** Cúcuta, 17 Apr 1879, *Kalbreyer 1184* (B). **Risaralda**: Pueblo Rico, Vereda Montebello, cerca a Los Cajones, subiendo hacia la base militar, 1974 m, 05°15′03″N, 76°06′22″W, 14 Apr 2007, *Vasco & Sundue 618* (NY). **Valle del Cauca**: Agua Clara, along highway from Buenaventura to Cali, 100 m, 6 Jun 1944, *Killip & Cuatrecasas 38919* (US).

ECUADOR. **Carchi**: Plateau above San Marcos de los Coaiqueres, on trail towards Gualpí Bajo, 1000 m, 01°06′N, 78°17′W, 7 Feb 1985, *Øllgaard et al.*

57291 (UC). **Carchi-Esmeraldas**: near Lita, 600 m, 19 May 1987, *van der Werff et al. 9511* (UC). **Cotopaxi**: Quevedo-Latacunga road, km 46 from Quevedo, 600 m, 00°55′S, 79°11′W, 4 Apr 1973, *Holm-Nielsen et al. 2920* (NY, UC). **Imbabura**: In the vicinity of the Río Verde, ca. 5 km SW from the village of Mani, Río Cachaco, 1300 m, 00°46′N, 78°28′W, 7 Jun 1980, *Sperling & Bleiweiss 5085* (US). **Pastaza**: Mera Canton, N northwest of Shell, 1100 m, 01°29′S, 78°04′W, 22 Jul 1992, *Fay & Fay 3686* (MO). **Pichincha**: Reserva Maquipucuna, along Sendero Principal to Cerro Sosa, 1300–1900 m, 23 Aug 2001, *Smith et al. 2827* (UC).

PERU. **Ancash**: La Pampa, Río Tavara, 1916, *Watkins s.n.* (US). **Pasco**: Oxapampa, Pichis Valley, San Matias ridge, a 0–12 km SW of Puerto Bermúdez, above Santa Rosa de Chivis, trail to Puerto Nuevo, 500–900 m, 10°20′S, 75°00′W, 8 Sep 1982, *Foster 8616* (MO).

BOLIVIA. **La Paz**: Ticunhuaya, 1524 m, Apr 1926, *Tate 1055* (US).

BRAZIL. **Amazonas**: Barcelos, Platô da Serra Aracá, pico em cima da Serra Norte, 1400 m, 00°57′S, 63°22′W, 22 Feb 1984, *Amaral 1649* (INPA, NY).

Moranopteris taenifolia is the most widely distributed species in the Neotropics (Fig. 35A), and it is the most common in the genus. The hairs are distinctive features of this species. These hairs are unbranched and branched with 1 or 2 setiform branches (Fig. 34F), although only unbranched hairs are observed on some specimens. Furthermore it has rhizome scales with long setiform projections on the margins, moderately setose leaves, gibbous segments, furcate veins, and two hydathodes per segment (Figs. 34A–E).

Moranopteris taenifolia can be confused with specimens of *Moranopteris nana* from Mato Grosso (Brazil) and French Guiana, because sometimes they have similar hairs — unbranched and sometimes branched with a setiform branch. However, the species can be easily distinguished by other characters (see comments under *M. nana*).

25. *Moranopteris trichomanoides* (Sw.) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Polypodium trichomanoides* Sw., Prodr. 131. 1788. *Grammitis trichomanoides* (Sw.) Ching, Bull. Fan Mem. Inst. Biol. 10: 16. 1940. *Xiphopteris trichomanoides* (Sw.) Copel., Gen. Fil. 215. 1947. *Micropolypodium trichomanoides* (Sw.) A. R. Sm., Novon 2: 423. 1992. LECTOTYPE (designated by Smith, 1995).—JAMAICA. Without exact locality, s.d., *O. P. Swartz s.n.* (S-n.v.; isolectotypes: FI-n.v., M-151256, P-637672; frag. B-Herb. Willd. 19670; UPS-Thunb. 24583-n.v.). **Figs. 35B, 36.**

Plants epiphytic. *Rhizomes* erect with scales 2.2–4.7 × 0.25–0.60 mm, these yellow-brown, lanceolate to linear, bases slightly cordate to truncate, apices acute, with apical or subapical gland-like cells, margins entire, or with small to large lateral projections, these sometimes furcate. *Leaves* erect to arcuate, determinate, 4.6–12.0(–17.0) cm × (3.5–)4.0–6.0(–7.5) mm, moderately setose; *stipes* 0.20–0.35(–2.0) cm long, brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costae* weakly visible with dark sclerenchyma adaxially,

sometimes weakly obscured by laminar tissue abaxially; *segments* patent to ascending, 70–90° to costae, 20–45(–84) pairs, (0.3–)0.8–2.0 mm apart, alternate to subopposite, gibbous, asymmetric, 1.9–4.2 × (0.8–)1.2–2.1 mm, oblong to oblong-lanceolate, rarely linear, deltate toward lamina bases, decurrent, apices rounded to slightly acute, margins plane, without hyaline cells; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2(3 or 4) hydathodes per segment, elliptic to obovate; *setae* 0.8–2.0 mm long, dark red-brown, on all sides of costae and laminar tissue; hairs present on costae and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, (1-)2- or 3-(4-)branched, the main branch (2-)3- or 4(–6)-celled, 0.1–0.2(–0.3) mm long, 1st branch 1- or 2-(3-)celled, < 0.1(–0.15) mm long, 2nd branch 1- or 2-(3-)celled, < 0.1(–0.15) mm long, 3rd and 4th branch, if present, 1-(2-)celled, < 0.1 mm long. *Sori* one per segment, round, 0.9–1.5(–1.9) mm diam.

Distribution.—Mexico, Guatemala, Honduras, Cuba, Jamaica, Haiti, Dominican Republic, and Guadeloupe; 800–2300 m.

Selected Specimens Examined.—MEXICO. **Chiapas**: La Trinitaria, east of Laguna Tzikaw, Monte Bello National Park, 1300 m, 23 Jan 1973, *Breedlove & Smith 32225-A* (NY). **Veracruz**: San Andrés Tuxtla, Ejido Barrio Lerdo, Fladas del Volcán San Martin Tuxtla, 1480 m, 18°33′N, 95°11′W, 24 Aug 2005, *Krömer & Acebey 2541* (UC).

GUATEMALA. **Alta Verapaz**: Cobán, 1350 m, May 1908, *von Türckheim 2383* (P). **Baja Verapaz**: Sierra de las Minas about 5 km, S of Purulhá, 1600 m, 2 Jan 1973, *Williams et al. 41935* (UC).

HONDURAS. **Comayagua**: Above El Achiote, above the plains of Siguatepeque, 1800 m, 28 Jul 1936, *Yuncker et al. 6659* (NY). **Cortés**: Cantilles a Jilinco, trail from cerro Cantiles to Cerro Jilinco, 2140 m, 15°30′N, 88°14′W, 20 Mar 1993, *Hawkins & Mejía 663* (TEFH). **Intibucá**: Cerro Duraznito, 25 km E de La Esperanza, 2000 m, 1 Mar 1985, *Gomez 114* (NY).

CUBA. Oriente, Crest of Sierra Maestra between Pico Turquino and La Bayamesa, 1350 m, 27–28 Oct 1941, *Morton & Acuna 3552* (NY).

JAMAICA. **Portland**: Along Murdocks Gap trail northwest from Portland Gap, 1676 m, 21 Apr 1951, *Proctor 5787* (PH). **Saint Thomas**: along trail between Portland Gap and Blue Mt. Peak, 1676 m, 22 Jan 1967, *Evans 2609* (LP). **Saint Andrew**: New Haven Gap, 1676 m, 4 Feb 1903, *Underwood 966* (NY); Slopes of Monkey Hill, above New Haven Gap, 1800 m, 22 Jun 1904, *Maxon 2752* (B, NY, P, S); Western slope of Mt. Horeb, above Hardwar Gap, 1371 m, 2 Apr 1958, *Yuncker 18597* (NY).

HAITI. Massif du Nord, Le Borgne, Morne Darras, eastern top of the mountain, 1150 m, 3 Sep 1945, *Ekman 4768* p.p. (K).

DOMINICAN REPUBLIC. Barahona, between Monteada Nueva and Loma Alta, 1524 m, 2 Aug 1950, *Howard 12319* (NY); Loma de la Sal, 1300–1400 m, 30–31 Oct 1968, *Liogier 13370* (NY); Santo Domingo, La Vega, Reserva Científica Ebano Verde, en la cima de loma La Sal, 1350–1440 m, 19°04′N, 70°34′W, 27 May 1992, *Zanoni et al. 45973* (NY).

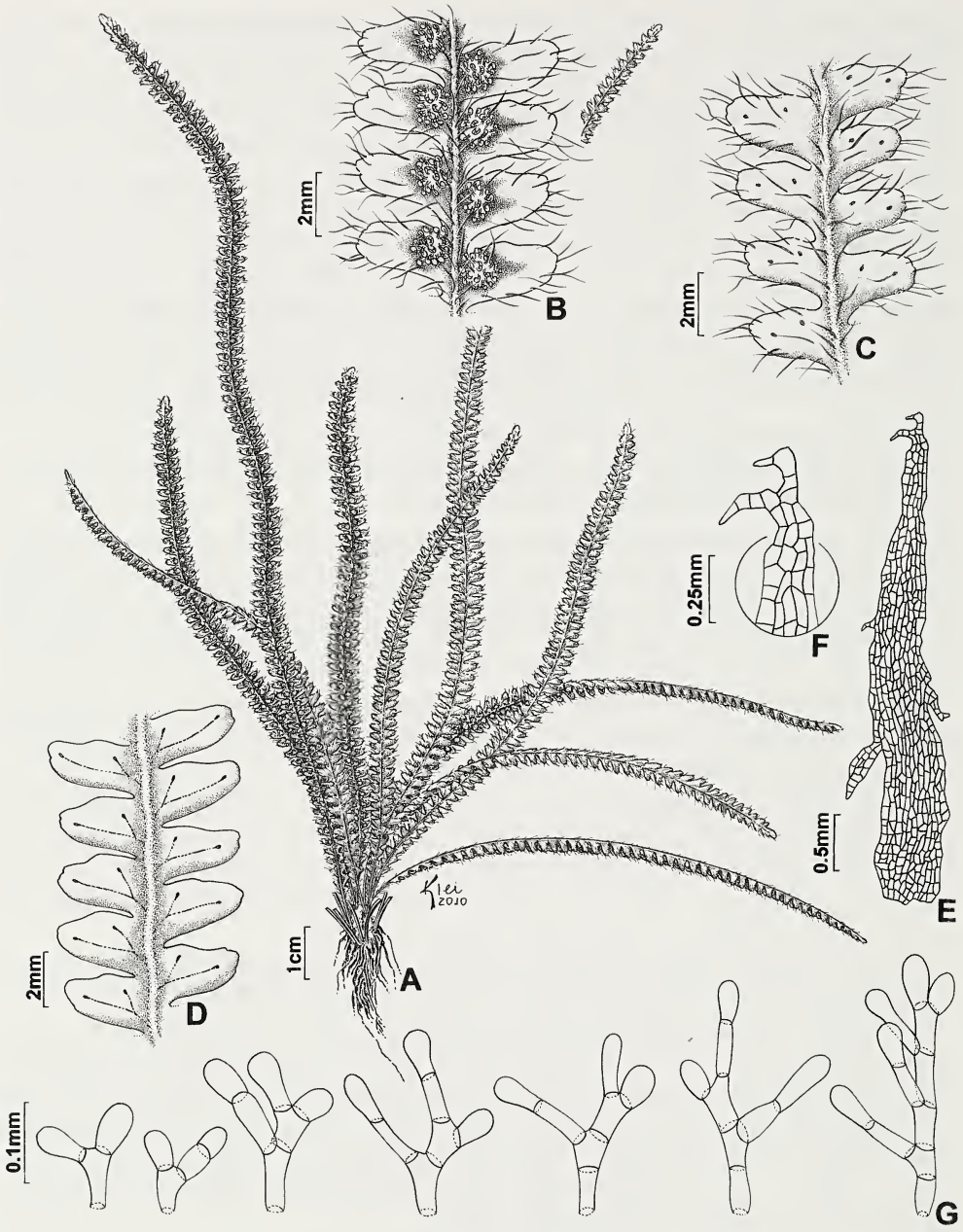

Fig. 36. *Moranopteris trichomanoides*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Apex of rhizome scale. G. Branched hairs (rehydrated) from costa. A–C: *Yuncker 18597* (NY). D, G: *Gomes 114*, NY). E, F: *Underwood 966* (NY).

GUADELOUPE. Rochers de Godard-Gommier, s.d., *L'Herminier 145* p.p. (P-696241, P-696242).

Moranopteris trichomanoides is characterized by rhizome scales with entire margins, gibbous segments, furcate veins, mostly two hydathodes per segment, and branched hairs (Figs. 36A–G).

Some specimens from Domican Republic have linear segments, which are more widely spaced than in other specimens, sometimes with three or four hydathodes per segment, but they are interpreted here as variation within *Moranopteris trichomanoides*.

Moranopteris simplex, an endemic species from Venezuela, is the most similar species to *M. trichomanoides* (see comments under *M. simplex*).

26. *Moranopteris truncicola* (Klotzsch) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Polypodium truncicola* Klotzsch var. *truncicola* Linnaea 20: 374. 1847. *Xiphopteris truncicola* (Klotzsch) Copel., Amer. Fern J. 42: 101. 1952. *Grammitis truncicola* (Klotzsch) C. V. Morton, Contr. U.S. Natl. Herb. 38: 98. 1967. *Micropolypodium truncicola* (Klotzsch) A. R. Sm., Novon 2: 423. 1992. LECTOTYPE (designated by Morton, 1967).—VENEZUELA. Colonia Tovar, s.d., *J. W. K. Moritz 252* p.p. (US-1421963; isolectotypes: B-200142665, B-200142666 p.p., K-575417, L-52405, P-632712, P-632713, frag. P-696231, frag. US-867057). **Figs. 4A, B, 35B, 37.**

Polypodium truncicola Klotzsch var. *minor* Klotzsch, Linnaea 20: 374. 1847. LECTOTYPE (designated by Morton, 1967).—VENEZUELA. Mérida, s.d., *J. W. K. Moritz 333* p.p. (US-1067579; isolectotypes: US-523530 p.p., B-200142667, B-200142666, K-575418 p.p., K-s.n. p.p; NY-148624, P-637671 p.p., frag. NY-148628).

Polypodium andinum Hook., Sec. cent. ferns, t. 6. 1860. *Grammitis andina* (Hook.) Ching, Bull. Fan. Mem. Inst. Biol., Bot. 10: 240. 1941. LECTOTYPE (designated by Morton, 1967).—ECUADOR. Banks of Río Hondacha, s.d., *W. Jameson 780* (K-575415; isolectotype: BM-n.v.).

Plants epiphytic. *Rhizomes* erect with scales 0.7–3.9 × 0.1–0.3 mm, these golden to yellow-brown, lanceolate to ligulate, bases slightly cordate to truncate, apices acute, rarely with apical or subapical gland-like cells, margins with long setiform projections, these red-brown, 0.1–0.2 mm long, rarely also with small lateral projections. *Leaves* erect to pendent, determinate, rarely ± indeterminate, (5–)7–20(–23) cm × (5–)6.5–11.5 mm, moderately to densely setose; *stipes* 0.2–0.4(–2.5) cm long, yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatifid, deeply pinnatifid or pinnatisect, gradually tapering proximally to a narrow wing, membranaceous to slightly chartaceous; *costae* visible with dark sclerenchyma or obscured by laminar tissue abaxially, obscured by laminar tissue adaxially; *segments* ascending, 65–80° to costae, 30–61(–70) pairs, 0.1–1.4 mm apart, opposite to subopposite, not gibbous to slightly gibbous, symmetric, (2.4–)2.9–7.0 × (1.5–)2.0–3.2 mm, oblong, deltate

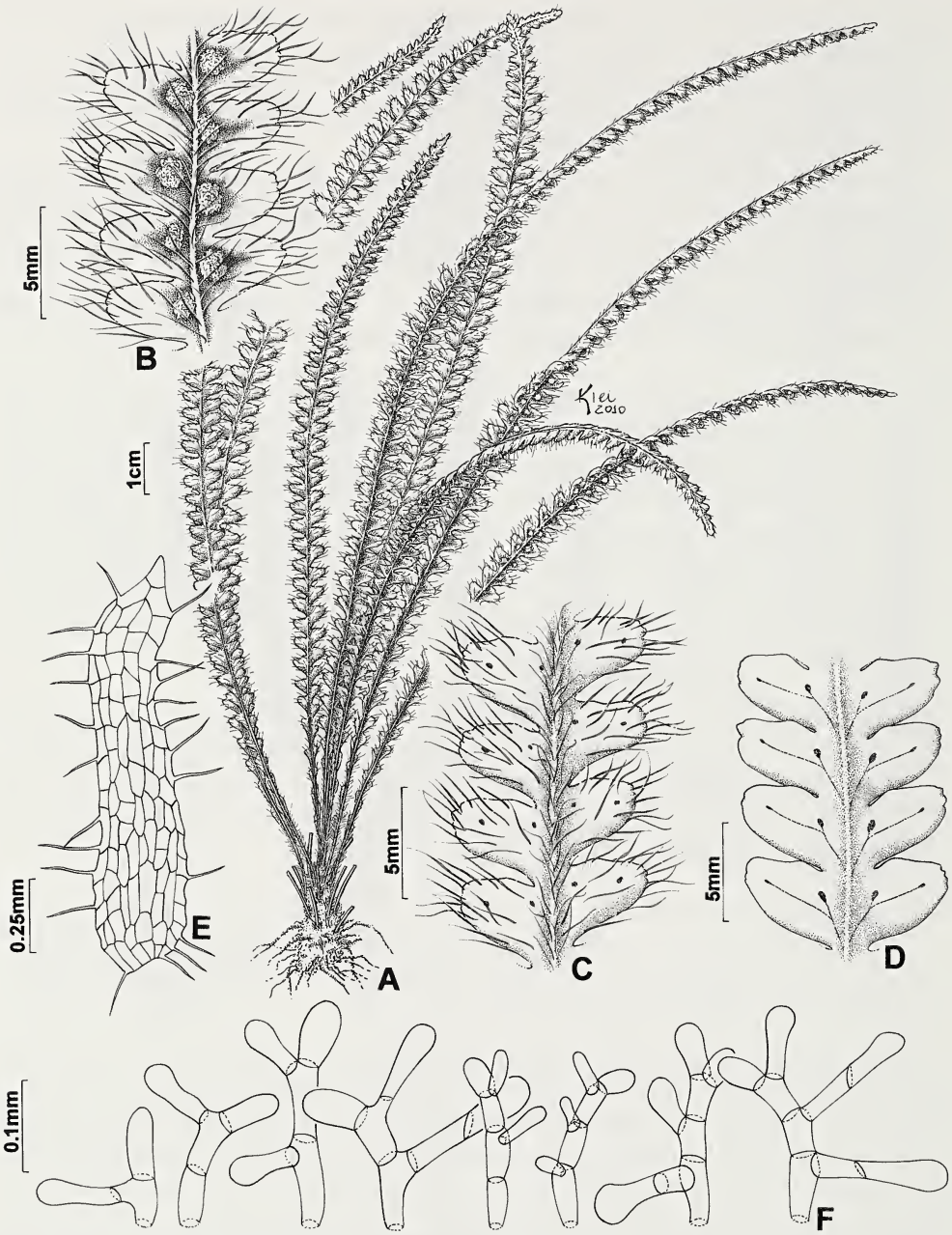

Fig. 37. *Moranopteris truncicola*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Branched hairs (rehydrated) from costa. A–C: *Carvalho et al. 367* (INPA). D, F: *Mostacero et al. 448* (VEN). E: *Boom et al. 6008* (VEN).

and decurrent, apices rounded to subtruncate, margins plane, entire to occasionally crenulate distally, hyaline cells inconspicuous; *veins* usually furcate, at least in fertile segments, or simple in sterile segments, obscure, (1)2(3) hydathodes per segment, elliptic to obovate, rarely linear; *setae* (0.9–) 1.2–3.3 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on costae and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, 1- or 2-(3-)branched, the main branch 2–4-celled, (0.05–)0.15(–0.25) mm long, 1st branch 1- or 2–celled, (0.05–)0.1(–0.25) mm long, 2nd branch, 1- or 2-celled, < 0.1(–0.15) mm long, 3rd branch, if present, 1-celled, < 0.1 mm long. *Sori* one per segment, round, (0.6–)1.0–1.7 mm diam.

Distribution.—Costa Rica, Guyana, Venezuela, Colombia, Ecuador, Peru, Bolivia, and Brazil; (600–)1050–2800 m.

Selected Specimens Examined.—COSTA RICA. **Alajuela**: Cascajal, Jun 1920, *Lankester s.n.* (K). **Cartago**: Quebrada Val Verde, 1500–1800 m, 09°43′N, 83°47′W, 1 Feb 1986, *Smith et al. 2157* (UC). **Heredia**: National Park Braulio Carrillo, entre OTS-Station La Selva e Volcán Barva, 1700 m, 7 Apr 2003, *Kluge 5932* (GOET). **Puntarenas**: Monte Verde, 1709 m, 10°20′19″N, 84°47′34″W, 1 Feb 2008, *Sundue et al. 1729* (NY, SP). **San José**: along Río Zurqui, Cordillera Central, 1400–1500 m, 10°03′N, 84°01′W, 18 Jan 1986, *Smith et al. 1737* (UC).

GUYANA. **Cuyuni-Mazaruni**: Upper slope Roraima, 1884, *im Thurn 348* (K).

VENEZUELA. **Amazonas**: Atabapo, Cerro Marahuaca, cumbre, sección suroriental, vecindades del zanjón, 2685 m, 03°37′N, 65°21′W, 15 Jan 1981, *Maguire et al. 65651* (MO, NY); Río Negro, Cerro de la Neblina, Neblina Massif, Camp 12, Venezuelan-Brazilian frontier, 1950 m, 26–27 Feb 1985, *Boom et al. 6008* p.p. (NY, UC, US, VEN). **Aragua**: Colonia Tovar and vicinity, 2100–2200 m, 26 Dec 1921, *Pittier 9997* (US). **Bolívar**: Meseta de Jaua, Cerro Jaua, cumbre de la porción Central, Occidental de la Meseta, 36 millas náuticas o 60 km, noroeste de la misión de Campamento Sanidad del Río Kanarakuni, 1922–2100 m, 04°45′N, 64°26′W, 22–27 Mar 1967, *Steyermark 98095* (NY, P, S, US). **Distrito Federal**: Cordillera de la Costa, cabeceras de la Quebrada Chacaíto, 2000–2050 m, 10°33′N, 66°52′W, 18 Oct 1991, *Meier & Reif 635* (M, UC). **Lara**: Buracal Valley, above Buena Vista, 1676 m, 20 Dec 1986, *Fay 1502* (UC). **Mérida**: Andres Bello, La Carbonera, ca. 13 min. NNW of Jají along Hwy 4, property of the Universidad de los Andes, 2000 m, 08°40N′, 71°26′W, 20 Nov 1982, *Smith et al. 1446* (MO, UC). **Miranda**: Parque Nacional "El Avila", subida al Pico Naiguata via Garete, arriba del canal de Garate, vertiente sur, al noreste de Caracas, 2100–2250 m, 10°33′N, 66°46′W, 20 Mar 1993, *Meier 3506* (VEN). **Portuguesa**: Sucre, localidad conocida como La Divisoria de la Concepción, 1500–1800 m, 09°18′N, 70°06′W, 23–26 Oct 1985, *Ortega et al. 2774* p.p. (UC). **Trujillo**: Orilla del Camino Laguna "Los Cedritos", Cerro Guaramacál, Boconó, 8 Sep 1980, *Stergios 2256* (UC). **Vargas**: Cordillera de la Costa, Serrania del Litoral, Monumento Natural Pico Codazzi, carretera Arco de la Colônia Tovar-Pro, Cruz, 1 km desde el Arco, Urb. Residencial Jenjibrillar, Sector La Neblina, 2280 m, 10°26′N, 67°14′30″W, 7 Feb 2000,

Mostacero et al. 448 (UC, VEN). **Yaracuy**: Sierra de Aroa, Cerro Negro, 1200–1800 m, 10°17′N, 69°01′W, 1–2 Apr 1980, *Liesner & González 9904* (MO, VEN).

COLOMBIA. **Antioquia**: Guatapé, 2316 m, 25 Feb 1880, *Kalbreyer 1472* (B, K). **Chocó**: San José del Palmar, Cerro del Torrá, vertiente occidental, abajo del helipuerto, Hoya del río Negro, vereda de Río Negro, 1900 m, 04°46′N, 76°29′W, 12 Aug 1988, *Ramos et al. 1309* (NY). **Cundinamarca**: Ridge above upper San Antonio, Río San Martín Valley, 15 km SE of Gutiérrez, 60 km S of Bogotá, 2775 m, 3 Aug 1944, *Grant 9821* (US). **Huila**: Cordillera Oriental, 15 km SE of Garzón, 2346 m, 1 Feb 1945, *Little Jr. 9354* (US). **Meta**: Cordillera Oriental, upper Río Manzanares Valley, 20 km southeast of Gutiérrez, 65 km south of Bogotá, 2710 m, 7 Aug 1944, *Grant 9879* (HUA, NY, US). **Nariño**: Reserva Natural La Planada, Sendero "La Vieja" e "La Piña", 1850–2050 m, 01°09′40″N, 77°58′78″W, 8 Jun 1996, *Bittner 2502* (UC). **Norte de Santander**: Chitagá, E slope of valley of Quebrada los Indios toward head, Fracción de Carvajal, 2460 m, 15 Nov 1942, *Fosberg 19119* (US). **Risaralda**: Pueblo Rico, Vereda Montebello, cerca de Los Cajones, 2162 m, 05°15′2.9″N, 76°06′19.9″W, 14 Apr 2007, *Vasco & Sundue 626* (NY). **Valle del Cauca**: Cali, San Antonio, Cerro La Horqueta, Cordillera Occidental, vertiente oriental, 2000 m, 28 Feb 1988, *Silverstone-Sopkin et al. 3605* (MO, UC).

ECUADOR. **Zamora-Chinchipe**: Estación Cientifica San Francisco, around refuge, 2490 m, 03°59′23″S, 79°04′20″W, 22 Sep 2003, *Lehnert 862* (UC).

PERU. **Amazonas**: Near the border with Dept. San Martín, 2000 m, 05°41′S, 77°48′W, 3 Apr 2001, *van der Werff et al. 16670* (MO, NY, UC); **San Martín**: 1950 m, 05°41′S, 77°48′W, 4 Mar 2001, *van der Werff et al. 16731* (MO, UC).

BOLIVIA. **Cochabamba**: Chapare, Territorio Indígena Parque Nacional Isiboro-Secure, Cordillera de Mosetenez, 1550 m, 16°14′S, 66°25′W, 5 Sep 2003, *Kessler et al. 13275* (LPB, UC). **La Paz**: Franz Tamayo, Región Madidi, Santo Domingo, sector arroyo Tintaya, 1468 m, 14°46′45″S, 68°35′30″W, 22 Oct 2006, *Cayola et al. 2527* (MO, UC).

BRAZIL. **Amazonas**: São Gabriel da Cachoeira, Parque Nacional da Neblina, trilha para a cachoeira do Anta, entre o acampamento Lajero e o Marco 5 da fronteira do Brazil com a Venezuela, 1900 m, 00°48′29″N, 65°58′56″W, 30 Dec 2004, *Carvalho et al. 367* (INPA).

Moranopteris truncicola is recognized by having rhizome scale margins with long setiform projections, moderately to densely setose and non-gibbous segments, furcate veins, two hydathodes per segment, and branched hairs (Figs. 37A–F).

The division of the laminae varies in *Moranopteris truncicola* from pinnatifid, to deeply pinnatifid or pinnatisect. No other differences could be found to correlate with blade division; consequently, all variations are here considered the same species. A form with pinnatifid leaves was named *Polypodium andinum* by Hooker (1860), and Klotzsch's (1847) types of *Polypodium truncicola* var. *major* and var. *minor* are deeply pinnatifid.

Moranopteris truncicola is most closely related to *M. microlepis* (see for comments). *Moranopteris microlepis* can be immediately distinguished by its more strongly gibbous segments (Fig. 22C).

27. *Moranopteris williamsii* (Maxon) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Polypodium williamsii* Maxon, Contr. U.S. Natl. Herb. 17: 547, pl. 34. 1916. *Xiphopteris williamsii* (Maxon) Copel., Amer. Fern J. 42: 101. 1952. *Grammitis williamsii* (Maxon) Lellinger, Amer. Fern J. 74: 59. 1984. *Micropolypodium williamsii* (Maxon) A. R. Sm., Novon 2: 423. 1992. TYPE.—BOLIVIA. **La Paz**: near Apolo, 1524 m, 7 Jul 1902, *R. S. Williams 1167* (holotype: US-700301; isotypes: US-1832079, NY-148625). **Figs. 23A, 38.**

Plants epiphytic or epipetric. *Rhizomes* erect with scales 0.8–1.5 × 0.4–0.6 mm, these golden to yellow-brown, ovate to oblong, bases cordate, apices acute, rarely with apical or subapical gland-like cells, margins entire. *Leaves* erect to arcuate, determinate, 3.5–12.0 cm × 3.5–6.0 mm, sparsely setose; *stipes* 0.4–3.0 cm long, yellow-brown to brown; *laminae* linear, pinnatisect, pinnate at bases, gradually tapering proximally, chartaceous; *costae* weakly visible with dark sclerenchyma abaxially, weakly obscured by laminar tissue adaxially; *segments* ascending, 40–45° to costae, 13–33(–40) pairs, 0.5–1.0 mm apart, alternate, gibbous, asymmetric, 2.5–3.2 × 0.9–1.5 mm, ovate to oblong, slightly decurrent, apices obtuse to acute, margins plane or slightly revolute, without hyaline cells; *veins* simple, obscure, 1 hydathode per segment, linear; *setae* 0.8–2.5 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on costae and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, 1- or 2-branched, the main branch 2- or 3-celled, 0.10–0.15 mm long, 1st branch 1- or 2-celled, (0.05–)0.1–0.2(–0.3) mm long, 2nd branch, if present, 1- or 2-celled, < 0.1 mm long. *Sori* one per segment, round, 1.3–2.0 mm diam.

Distribution.—Endemic to Bolivia; 1500–2000 m.

Specimens Examined.—BOLIVIA. **Cochabamba**: José Carrasco Torrico, 130 km antigua carretera Cochabamba-Villa Tunari, 2000 m, 17°07′S, 65°36′W, 10 Jul 1996, *Kessler 7173* p.p. (GOET, LPB, UC).

Moranopteris williamsii is known only from a few collections; it is easily recognized by way of its rhizome scales with entire margins, sparsely setose leaves, gibbous segments, and simple veins (Figs. 38A–F). It is not likely to be confused with other species of *Moranopteris*.

Moranopteris williamsii resembles *M. cookii* and *M. zurquina* by having the similar scales with entire margins and one hydathode per segment. However, these species do not have gibbous segments; also *M. cookii* differs by having patent segments, whereas *M. zurquina* has deltate segments with rounded apices.

28. *Moranopteris zurquina* (Copel.) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Xiphopteris zurquina* Copel., Amer. Fern J. 42: 99. 1952. *Grammitis zurquina* (Copel.) F. Seym., Phytologia 31: 175. 1975. *Micropolypodium zurquinum* (Copel.) A. R. Sm., Novon 2: 423. 1992. TYPE.—COSTA RICA. **Heredia**: northeast of San Isidro, "Cerros de Zurqui", s.d., *P. C. Standley & J. Valerio 50495* (holotype: US-1308419). **Figs. 9A, 39.**

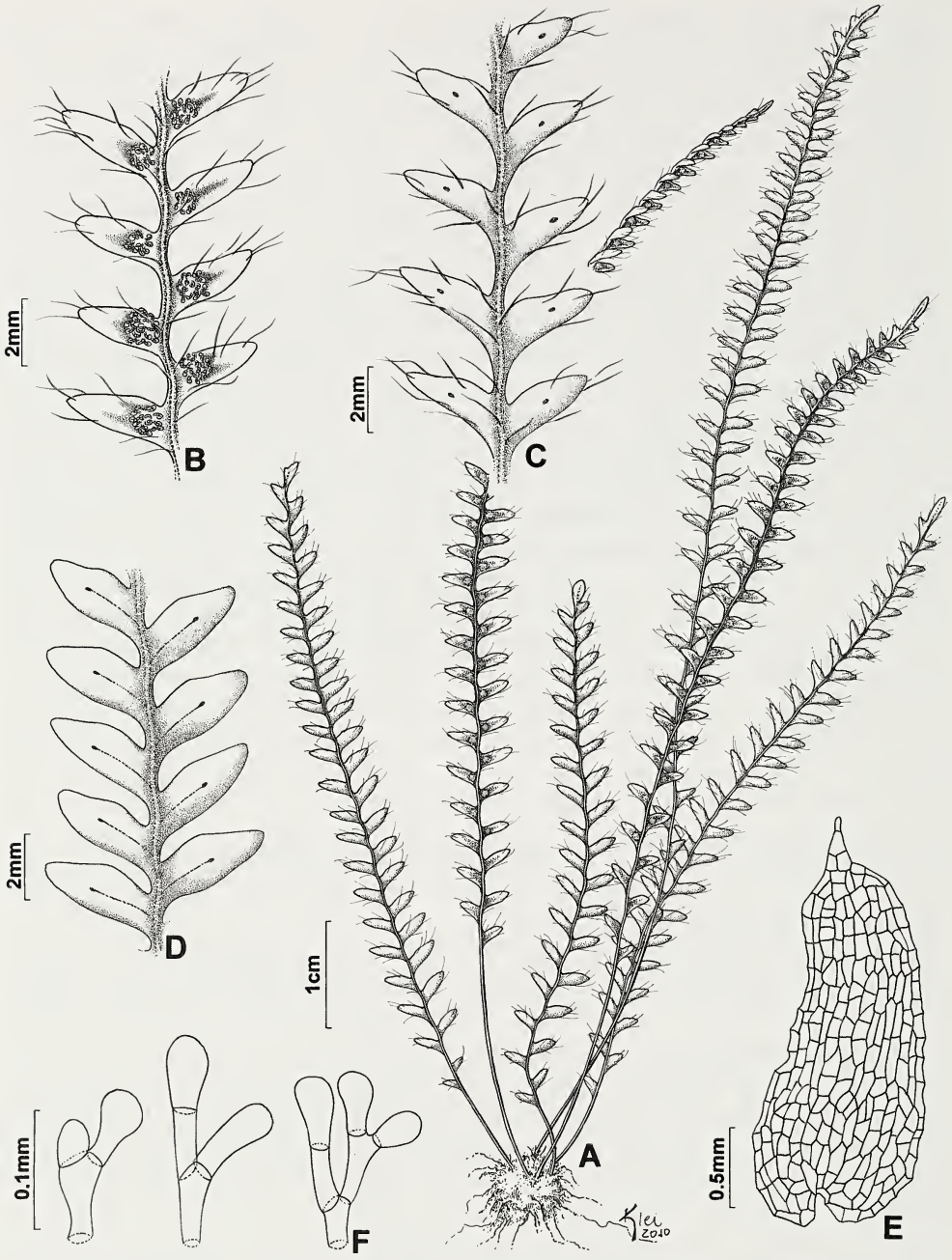

Fig. 38. *Moranopteris williamsii*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Branched hairs (rehydrated) from costa. A–F: *Kessler et al. 7173* (LPB).

Plants epiphytic. *Rhizomes* erect with scales 1.4–3.0 × 0.2–0.3 mm, these golden to yellow-brown, lanceolate to slightly linear, bases sligthly cordate to truncate, apices acute, rarely with apical or subapical gland-like cells, margins entire, or rarely with small lateral projections also. *Leaves* erect to arcuate, determinate, 6.0–12.5 cm × 2.5–5.0 mm, sparsely to moderately setose; *stipes* (0.5–)0.7–2.5 cm long., yellow-brown to dark brown, narrowly winged; *laminae* linear, pinnatisect, gradually tapering proximally to a narrow wing, chartaceous; *costae* weakly visible with dark sclerenchyma abaxially, weakly obscured by laminar tissue adaxially; *segments* ascending, 50–60°(–70) to costae, (15–)26–41 pairs, 0.5–1.8 mm apart, alternate, subopposite or opposite at lamina bases, not gibbous, symmetric, 1.3–2.7 × 0.9–1.4 mm, deltate to oblong, decurrent, apices rounded to acute, margins plane, without hyaline cells; *veins* simple, obscure, 1 hydathode per segment, elliptic, rarely obovate or linear; *setae* (0.7–)1.0–2.2(–3.5) mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on stipes, costae, and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, rarely with branches tinged red-brown, (1-)2-(3-)branched, the main branch 3-(4-)celled, 0.1–0.2 mm long, 1st branch (1-)2- or 3-celled, (0.05–)0.10–0.15(–0.25) mm long, 2nd branch, if present, 1- or 2-celled, < 0.1(–0.15) mm long, 3rd branch, if present, 1- or 2-celled, < 0.1 mm long. *Sori* one per segment, round, 0.8–1.0 mm diam.

Distribution.—Endemic to Costa Rica; 1100–2500 m.

Selected Specimens Examined.—COSTA RICA. **Guanacaste**: Cantón de Liberia, P. N. Guanacaste, Cordillera de Guanacaste, Estación Cacao, 1100–1500 m, 10°55′45″N, 85°28′15″W, 5 Sep 1996, *Rojas & Mata 3021* (UC). **Heredia**: Braulio Carillo National Park, 2500 m, 2 May 2003, *Kluge 6458* (GOET). **San José**: 10 km N of San Rafael de Heredia on Volcán Barba, 1950 m, 30 Jul 1967, *Bishop 851* (UC); Idem, *Mickel 3030* p.p. (NY).

Moranopteris zurquina has rhizome scales with entire margins, deltate segments, simple veins, and one hydathode per segment (Figs. 39A–E).

Moranopteris serricula from the Lesser Antilles and Venezuela is the most similar species, but differs mostly by having furcate veins and two hydathodes per segment.

The following specimens of *Moranopteris zurquina*: *Haufler et al. 6936* p.p. (UC) and *Rojas & Soto 4258* (NY) in part are atypical by having occasionally furcate veins and two hydathodes per segment, and slightly gibbous segments. These characters are suggestive of *M. serricula*, but more studies are necessary especially because *M. zurquina* is known only a few collections.

29. *Moranopteris* x*bradei* (Labiak & F. B. Matos) R. Y. Hirai & J. Prado, Taxon 60: 1132. 2011. *Micropolypodium* x*bradei* Labiak & F. B. Matos, Brittonia 59: 182. 2007. TYPE.—BRAZIL. **Rio de Janeiro**: Terezópolis, Serra dos Órgãos, Rio Paquequer, 17 Jul 1940, *A. C. Brade 16676 p.p.* (holotype: RB-43148).

Plants epipetric. *Rhizomes* short-creeping with scales 0.7–2.0 × 0.15–0.40 mm, these golden to yellow-brown, lanceolate, bases slightly cordate,

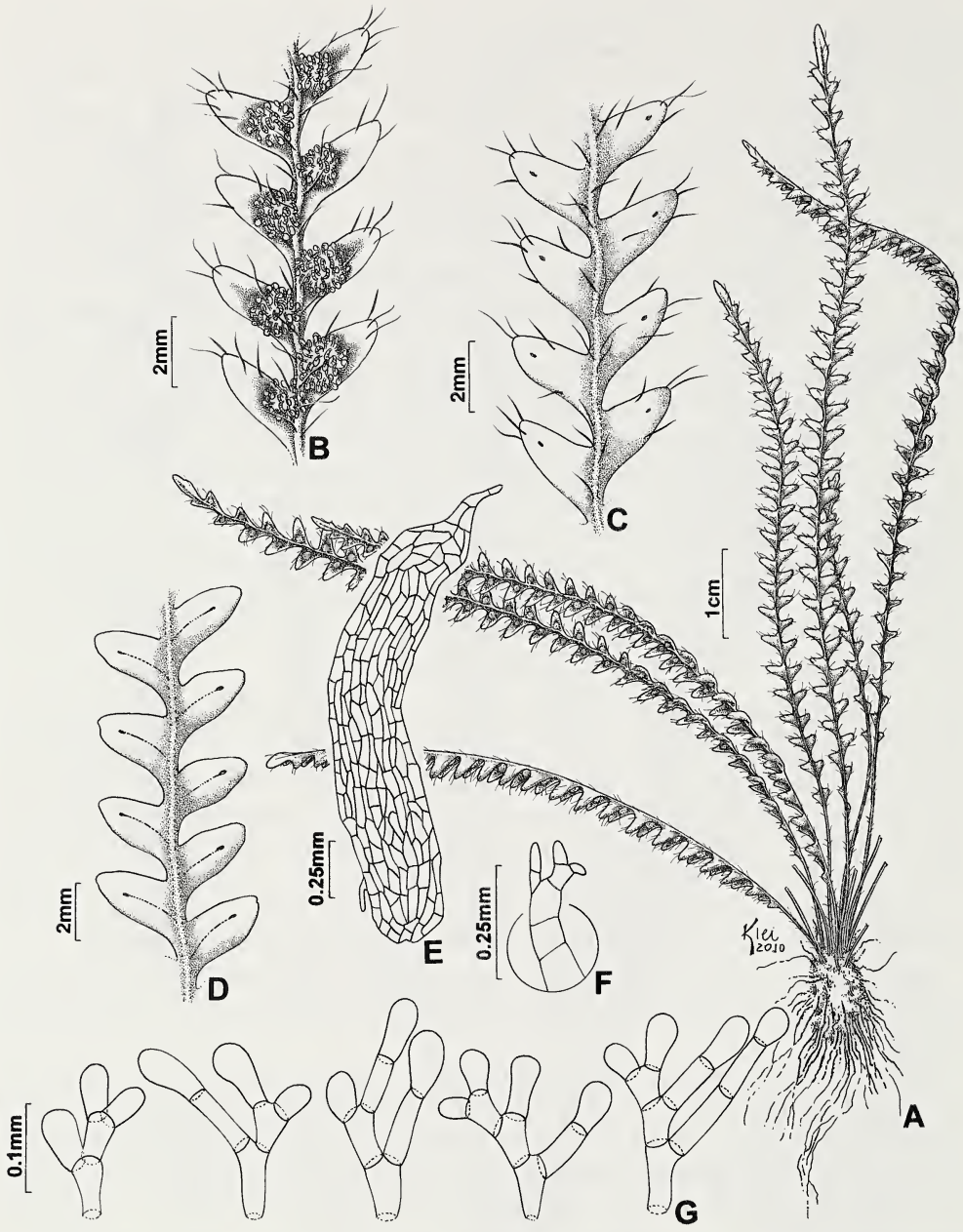

FIG. 39. *Moranopteris zurquina*. A. Habit. B. Fertile segments showing sori and setae, abaxial view. C. Segments showing setae and hydathodes, adaxial view. D. Venation (cleared lamina). E. Rhizome scale. F. Apex of rhizome scale. G. Branched hairs (rehydrated) from costa. A–G: *Mickel 3030* (NY p.p.).

apices attenuate, margins entire, or rarely with small lateral projections also. *Leaves* erect to arcuate, determinate, 2.5–9.2 × 0.3–1.2 cm, sparsely setose; *stipes* 0.5–1.0 cm long, brown, narrowly winged; *laminae* linear to linear-lanceolate, pinnatisect or pinnatisect-pinnatifid, gradually tapering proximally to a narrow wing, chartaceous; *costae* obscured by laminar tissue abaxially and adaxially; *segments* ascending, 40–70° to costa, 11–12 pairs, 0.1–0.3 mm apart, alternate, not gibbous to slightly gibbous, symmetric, 5.0–10.0 × 1.5–3.0 mm, deltate to linear, pinnatifid, decurrent at base, apices rounded, margins slightly lobate and revolute, without hyaline cells; *veins* furcate or pinnate, obscure, (1)2–8 hydathodes per segment, round to elliptic; *setae* 0.9–1.1 mm long, dark red-brown, on all sides of stipes, costae, and laminar tissue; *hairs* present on stipes, costae, and laminar tissue (mainly near costae abaxially), hyaline, slightly red-brown, branched or rarely unbranched, branched hairs mostly 2- or 3-branched, the main branch 3-celled, 0.1–0.2 mm long, 1st, 2nd and 3rd branches 1- or 2-celled, < 0.1 mm long. *Sori* 1–6 per segment, round to oblong, 0.8–2.0 mm diam.

Distribution.—Endemic to the state of Rio de Janeiro, southeast Brazil; 1000 m.

Moranopteris x*bradei* is known from only one collection by Brade. Labiak and Matos (2007) believed that the specimen had aborted spores. However, we looked at the spores and concluded that there are normal spores plus some immature sporangia and spores. This specimen could be a variation or atypical specimen of *Moranopteris achilleifolia*, but without more data we prefer to give it hybrid status for now.

Names of uncertain application

Polypodium gibbosum Fée, Mém. Foug. 6: 8, t. 2, f. 2. 1854. TYPE.—Mexico. Oaxaca, 2400–2600 m, *H. Galeotti s.n.* (P or RB n.v.).

It was not possible to locate the type-specimen. Based only on Fée's protologue and illustration, we cannot ascertain the application of this name.

Micropolypodium setulosum (Rosenst.) A. R. Sm., Novon 2: 423. 1992. *Polypodium setulosum* Rosenst., Repert. Spec. Nov. Regni Veg. 10: 277. 1912. *Xiphopteris setulosa* (Rosenst.) Copel., Amer. Fern J. 42: 108. 1952. *Grammitis setulosa* (Rosenst.) F. Seym., Phytologia 31: 175. 1975. TYPE.—COSTA RICA. **San José**: El General, 656 m, *A. Tonduz s.n.* (Herb. *Jiménez* 214, n.v.; frag. US!).

The fragment of the type at US lacks a rhizome. Consequently, it is not possible to place this name. The fragment resembles a small plant of *Moranopteris basiattenuata* or *M. plicata* based on the branched hairs and also the general appearance of the leaves (segments, setae, etc.). Rosenstock (1912) described *Polypodium setulosum* as having two setae on the margins of rhizome scales. *Moranopteris basiattenuata* has rhizome scales with entire

margins and with small lateral projections, whereas *M. plicata* has only setiform projections on its margins. If the projections described by Rosenstock are setiform as on the rhizome scales of *M. plicata*, this species can be considered synonymus with *Micropolypodium setulosum*. Furthermore, the hairs observed on the fragment at US are 1- or 2-branched; such hairs are more similar to those of *M. plicata* than *M. basiattenuata*. *Smith et al. 2200* (UC) from Cartago, Costa Rica (=*M. plicata*), resembles Rosenstock's description. To resolve this problem it is necessary to find and study the holotype.

Polypodium piligerum Hook., Icon. pl. t. 321. 1841. TYPE.—ECUADOR. Canar-Azuay, *W. Jameson s.n.* (K-n.v.).

The type was not found at K. See comments under *Moranopteris longisetosa*.

Acknowledgments

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APPENDIX 1: LIST OF TAXA

1. *Moranopteris achilleifolia* (Kaulf.) R. Y. Hirai & J. Prado
2. *Moranopteris aphelolepis* (C. V. Morton) R. Y. Hirai & J. Prado
3. *Moranopteris basiattenuata* (Jenman) R. Y. Hirai & J. Prado
4. *Moranopteris blepharidea* (Copel.) R. Y. Hirai & J. Prado
5. *Moranopteris caucana* (Hieron.) R. Y. Hirai & J. Prado
6. *Moranopteris cookii* (Underw. & Maxon) R. Y. Hirai & J. Prado
7. *Moranopteris gradata* (Baker) R. Y. Hirai & J. Prado
8. *Moranopteris grisebachii* (Underw. ex C. Chr.) R. Y. Hirai & J. Prado
9. *Moranopteris hyalina* (Maxon) R. Y. Hirai & J. Prado
10. *Moranopteris killipii* (Copel.) R. Y. Hirai & J. Prado
11. *Moranopteris knowltoniorum* (Hodge) R. Y. Hirai & J. Prado
12. *Moranopteris liesneri* (A. R. Sm.) R. Y. Hirai & J. Prado
13. *Moranopteris longisetosa* (Hook.) R. Y. Hirai & J. Prado
14. *Moranopteris microlepis* (Rosenst.) R. Y. Hirai & J. Prado
15. *Moranopteris nana* (Fée) R. Y. Hirai & J. Prado
16. *Moranopteris nimbata* (Jenman) R. Y. Hirai & J. Prado
17. *Moranopteris perpusilla* (Maxon) R. Y. Hirai & J. Prado
18. *Moranopteris plicata* (A. R. Sm.) R. Y. Hirai & J. Prado
19. *Moranopteris rupicola* R. Y. Hirai & J. Prado
20. *Moranopteris serricula* (Fée) R. Y. Hirai & J. Prado
21. *Moranopteris setosa* (Kaulf.) R. Y. Hirai & J. Prado
22. *Moranopteris sherringii* (Baker) R. Y. Hirai & J. Prado
23. *Moranopteris simplex* R. Y. Hirai & J. Prado

24. *Moranopteris taenifolia* (Jenman) R. Y. Hirai & J. Prado
25. *Moranopteris trichomanoides* (Sw.) R. Y. Hirai & J. Prado
26. *Moranopteris truncicola* (Klotzsch) R. Y. Hirai & J. Prado
27. *Moranopteris williamsii* (Maxon) R. Y. Hirai & J. Prado
28. *Moranopteris zurquina* (Copel.) R. Y. Hirai & J. Prado
29. *Moranopteris* x*bradei* (Labiak & F. B. Matos) R. Y. Hirai & J. Prado

APPENDIX 2. LIST OF NAMES

The numbers in parentheses refer to the species numbers assigned in the taxonomic treatment and listed in Appendix 1.

- *Ctenopteris achilleifolia* (Kaulf.) J. Sm. (1)
- *Ctenopteris gradata* (Baker) Copel. (7)
- *Ctenopteris myriophylla* (Mett. ex Hook. & Baker) Copel. (13)
- *Ctenopteris schwackei* (Christ) Copel. (7)
- *Grammitis achilleifolia* (Kaulf.) R. M. Tryon & A. F. Tryon (1)
- *Grammitis andina* (Hook.) Ching (26)
- *Grammitis aphelolepis* C. V. Morton (2)
- *Grammitis basalis* (Maxon) Lellinger (6)
- *Grammitis basiattenuata* (Jenman) Proctor (3)
- *Grammitis basiattenuata* (Jenman) Proctor var. *valens* Mickel & Beitel (3)
- *Grammitis blanchetii* (C. Chr.) A. R. Sm. (15)
- *Grammitis blepharidea* (Copel.) Stolze (4)
- *Grammitis blepharodes* (Maxon) F. Seym. (24)
- *Grammitis blepharolepis* (C. Chr.) C. V. Morton (24)
- *Grammitis buesii* (Maxon) Lellinger (4)
- *Grammitis caucana* (Hieron.) C. V. Morton (5)

Grammitis cookii (Underw. & Maxon) F. Seym. (6)
Grammitis daguensis (Hieron.) C. V. Morton (24)
Grammitis exigua (Fée) Brade (15)
Grammitis gradata (Baker) R. M. Tryon & A. F. Tryon (7)
Grammitis grisebachii (Underw. ex C. Chr.) Proctor (8)
Grammitis hyalina (Maxon) F. Seym. (9)
Grammitis killipii (Copel.) Lellinger (10)
Grammitis knowltoniorum (Hodge) Proctor (11)
Grammitis liesneri A. R. Sm. (12)
Grammitis micropteris (C. Chr.) Brade (21)
Grammitis myosuroides Raddi (21)
Grammitis myriophylla (Mett. ex Hook. & Baker) C. V. Morton (13)
Grammitis nimbata (Jenman) Proctor (16)
Grammitis plicata A. R. Sm. (18)
Grammitis serricula (Fée) Proctor (20)
Grammitis setosa (Kaulf.) C. Presl (21)
Grammitis sherringii (Baker) Proctor (22)
Grammitis taenifolia (Jenman) Proctor (24)
Grammitis trichomanoides (Sw.) Ching (25)
Grammitis truncicola (Klotzsch) C. V. Morton (26)
Grammitis williamsii (Maxon) Lellinger (27)
Grammitis zurquina (Copel.) F. Seym. (28)
Micropolypodium achilleifolium (Kaulf.) Labiak & F. B. Matos (1)
Micropolypodium aphelolepis (C. V. Morton) A. R. Sm. (2)

Micropolypodium basiattenuatum (Jenman) A. R. Sm. (3)
Micropolypodium blepharideum (Copel.) A. R. Sm. (4)
Micropolypodium caucanum (Hieron.) A. R. Sm. (5)
Micropolypodium cookii (Underw. & Maxon) A. R. Sm. (6)
Micropolypodium gradatum (Baker) Labiak & F. B. Matos (7)
Micropolypodium grisebachii (Underw. ex C. Chr.) A. R. Sm. (8)
Micropolypodium hyalinum (Maxon) A. R. Sm. (9)
Micropolypodium knowltoniorum (Hodge) A. R. Sm. (11)
Micropolypodium liesneri (A. R. Sm.) A. R. Sm. (12)
Micropolypodium nanum (Fée) A. R. Sm. (15)
Micropolypodium nimbatum (Jenman) A. R. Sm. (16)
Micropolypodium perpusillum (Maxon) A. R. Sm. (17)
Micropolypodium plicatum (A. R. Sm.) A. R. Sm. (18)
Micropolypodium serricula (Fée) A. R. Sm. (20)
Micropolypodium setosum (Kaulf.) A. R. Sm. (21)
Micropolypodium sherringii (Baker) A. R. Sm. (22)
Micropolypodium taenifolium (Jenman) A. R. Sm. (24)
Micropolypodium trichomanoides (Sw.) A. R. Sm. (25)
Micropolypodium truncicola (Klotzsch) A. R. Sm. (26)
Micropolypodium williamsii (Maxon) A. R. Sm. (27)
Micropolypodium zurquinum (Copel.) A. R. Sm. (28)
Micropolypodium x*bradei* Labiak & F. B. Matos. (29)
Polypodium achilleifolium Kaulf. (1)
Polypodium andinum Hook. (26)
Polypodium basale Maxon (6)
Polypodium basiattenuatum Jenman (3)
Polypodium blanchetii C. Chr. (15)
Polypodium blepharideum Copel. (4)
Polypodium blepharodes Maxon (24)
Polypodium blepharodes Maxon var. *microlepis* Rosenst. (14)
Polypodium blepharolepis C. Chr. (24)
Polypodium buesii Maxon (4)
Polypodium caucanum Hieron. (5)
Polypodium cookii Underw. & Maxon (6)
Polypodium daguense Hieron. (24)
Polypodium exiguum Fée (15)
Polypodium exiguum Griseb. (8)
Polypodium gracillimum Hieron. (24)
Polypodium gradatum Baker (7)
Polypodium grisebachii Underw. ex C. Chr. (8)
Polypodium hirsutulum Fée (7)
Polypodium hyalinum Maxon (9)
Polypodium knowltoniorum Hodge (11)
Polypodium longisetosum Hook. (13)
Polypodium micropteris C. Chr. (21)
Polypodium myriophyllum Mett. ex Hook. & Baker (13)
Polypodium nanum Fée (15)
Polypodium nimbatum Jenman (16)
Polypodium perpusillum Maxon (17)
Polypodium schwackei Christ (7)
Polypodium serricula Fée (20)
Polypodium sherringii Baker (22)
Polypodium sintenisii Hieron. (24)
Polypodium taenifolium Jenman (24)
Polypodium trichomanoides Sw. (25)

Polypodium truncicola Klotzsch var. *truncicola* (26)
Polypodium truncicola Klotzsch var. *minor* Klotzsch (26)
Polypodium williamsii Maxon (27)
Terpsichore achilleifolia (Kaulf.) A. R. Sm. (1)
Terpsichore gradata (Baker) A. R. Sm. (7)
Terpsichore longisetosa (Hook.) A. R. Sm. (13)
Xiphopteris aphelolepis (C. V. Morton) Pic.-Serm. (2)
Xiphopteris basiattenuata (Jenman) Copel. (3)
Xiphopteris blepharidea (Copel.) Copel. (4)
Xiphopteris blepharodes (Maxon) Copel. (24)
Xiphopteris blepharolepis (C. Chr.) Copel. (24)
Xiphopteris buesii (Maxon) Copel. (4)
Xiphopteris caucana (Hieron.) Copel. (5)
Xiphopteris cookii (Underw. & Maxon) Copel. (6)
Xiphopteris daguensis (Hieron.) Copel. (24)
Xiphopteris grisebachii (Underw. ex C. Chr.) Copel. (8)
Xiphopteris hyalina (Maxon) Copel. (9)
Xiphopteris killipii Copel. (10)
Xiphopteris knowltoniorum (Hodge) Copel. (11)
Xiphopteris myriophylla (Mett. ex Hook. & Baker) Crabbe (13)
Xiphopteris nana (Fée) Copel. (15)
Xiphopteris nimbata (Jenman) Copel. (16)
Xiphopteris perpusilla (Maxon) Copel. (17)
Xiphopteris serricula (Fée) Copel. (20)
Xiphopteris setosa Kaulf. (21)
Xiphopteris sherringii (Baker) Copel. (22)
Xiphopteris taenifolia (Jenman) Copel. (24)
Xiphopteris trichomanoides (Sw.) Copel. (25)
Xiphopteris truncicola (Klotzsch) Copel. (26)
Xiphopteris williamsii (Maxon) Copel. (27)
Xiphopteris zurquina Copel. (28)

APPENDIX 3: LIST OF EXSICCATAE

The number in parentheses refers to the species numbers assigned in the xonomic treatment and listed in Appendix 1. Collection numbers in boldface e types.

Abendroth, A.: 517 (1)
Acevedo-Rodríguez, P.: 2967 (24)
Acevedo-Rodríguez, P. *et al.*: 1298 (24); 6007 (15)
Ackerman, J. *et al.*: 1616 (24)
Adolfo, Bro.: 76 (4)
Albert de la Rüe E.: s.n. (15)
Allorge, P.: s.n. (20); s.n. (24)
Almeida, T. E. *et al.*: 552 (21)
Alston, A. H. G.: 5101 (24); 7560 (15)
Amaral, I. L. do: 1649 (24)

Amaral, I. L. do *et al.*: 1010 (15)
- Anderson, A. B.: 359 (15)
- Araújo, H. S.: s.n. (1)
- Araújo, I.: 36, 37, 110, 128, 144, 158, 228 (15)
- Arbeláez, A. *et al.*: 236 (24)
- Atehortúa, L. & Callejas, R.: 292 (18)

Atwood, J. T.: 5453 (24)
Axelrod, F. & Axelrod, A. B.: 9884 (24)
Axelrod, F. & Herscoviz, S.: 5169 (24)
Axelrod, F. & Proctor, G.: 375 (24)
Axelrod, F. & Rodríguez, I.: 7682, 8596, 8607 (24)
Axelrod, F. *et al.*: 408 (24)
Aymard, G. C.: 5816 (15)
Bach, K. *et al.*: 1084 (13); 1634, 1759 (4); 1853 (13); 1880 (4)
Badini, J.: 56 (1); 79, 101 (7); s.n. (7)
Baker, R.: s.n. (28)
Baracaldo, P. S.: 128 (5)
Barbosa, E. & Ribas, O. S.: 434 (1)
Barbosa, E. & Silva, J. M.: 496 (1)
Barbosa, H.: s.n. (1)
Barcia, J.: 105, p.p. (21); 901, p.p. (21); 983, 1177 (1); 1203 (21)
Barnard *et al.*: 544 (24)
Barros, F. & Ribeiro, J. E. L. S.: 2046 (1); 2048 (7)
Barros, W. D.: 723 (1)
Baudouin, A.: 646, p.p. (20); 646, p.p. (24)
Bautista, H. P. & Barroso, G.: 235, 271 (1)
Beaupertuis, M.: 1322 (20)
Beck, S. G.: 17493, 21973 (4)
Beitel, J.: 85283 (18); 85303, p.p. (18); 85303, p.p. (24)
Bena, P.: 1014, 1866 (24)
Berg, C. C. *et al.*: P19492, P19494 (15)
Beyrich, H. K.: s.n. (1); s.n. (21)
Beyrich, H. K. & Uhlmorm, O.: s.n. (1)
Bishop, E.: 805 (24); 811 (3); 833 (14); 847 (24); 851 (28); 874 (24); 1972 (2)
Bittner, J.: 2502 (26); 2670 (10)
Bittner, J. & Herrera, G.: 2004 (24)
Blanchet, J. S.: **8**, 3944 (15)
Boeke, J. D. & Jaramillo A. J.: 2701 (2)
Boldingh, I.: 1837B (24)
Boom, B. M. & Gopaul, D.: 7431, 7521 (24)
Boom, B. M. *et al.*: 6008, p.p. (5); 6008, p.p. (26); 8606 (15)
Bordin, J. *et al.*: s.n. (7)
Borgo, M.: 703 (1)
Boudrie, M.: 2862, 3284 (15)
Boudrie, M. *et al.*: 4081 (15)
Bovini, M. G. *et al.*: 2241 (1)
Brade, A. C.: 16, p.p. (24); 21 (26); 80 (24); **80b** (14); 80b, p.p. (14); 80b, p.p. (24); 81 (26); 5226 (7); 6592 (1); 8400 (21); 9215 (1); 9386, 10002 (7); 10318 (21); 10849, p.p. (7); 11630 (1); 12697, 13999 (21); 14029, 15188 (1); 15888, 16400, 16401 (21); 16610 (7); **16676** (29); 16677 (1); 16824 (7); 17353 (1); 17461 (7); 18781 (1); 19156 (7); 19980 (1); 19982 (7); 21124, 21298 (1); 21340 (7); 21359, 21360 (1); 31098 (21); s.n. (14); s.n. (21)
Brade, A. C. & Santos Lima, J. J.: 11629 (7)
Braga, J. M. A. *et al.*: 3797 (1)
Breedlove, D. E.: 30809 (24)
Breedlove, D. E. & Smith, A. R.: 32225-A (25)

Breedlove, D. E. & Thorne, R. F.: 30160 (3)
Brenes, A. M.: 11679a, 14212 (24), 14214 (15); 14839a, 16133b, 19954, 20018, 22337 (24); s.n. (24)
Breutel, J. C.: s.n. (24)
Bristan, N.: 1239 (15)
Britton, E. G.: 1140 (25)
Britton, N. L. & Bruner, E. M.: 7584 (24)
Britton, N. L. & Cowell, J. F.: 515, p.p. (24)
Britton, N. L. & Hess, W. E.: 2301 (24)
Britton, N. L. *et al.*: 1269 (24)
Broadway, W. E.: 5659 (24), 6061 (15), 7106, 9954 (24); s.n. (24)
Brooke, W. M. A.: 6730 (13)
Bües, C.: A28 (4); A38 (9); **A45**, p.p. (4); A45, p.p. (9); 1963 (9)
Burch, D.: 4576 (24)
Byer, M. D.: 66-1008 (24)
Byron: s.n. (15)
Byron & Luiz Coelho: 397 (15)
Cabrera, I. R. & van der Werff, H.: 15774 (26); 15790 (5)
Camp, W. H.: **E-5107**, E-5139 (2)
Campos, J. *et al.*: 5970 (18)
Cantarero, K. J.: 92 (24)
Capell, S. J. P.: s.n. (7)
Cárdenas, M.: 2091 (13)
Carnevali, G. & Santana, G.: 2441 (18)
Carreira, L. *et al.*: 780 (15)
Carter, A. *et al.*: 241B (24)
Carvalho, F. A. *et al.*: 367 (26)
Cayola, L. *et al.*: 2527 (26)
Christenhusz, M. J. M.: 4208 (11); 4214 (24)
Christenhusz, M. J. M. & Katzer, F.: 3910, p.p. (20), 3930 (20)
Chrysler, M. A.: 4601 (25); 4922, 6846 (24)
Chrysler, M. A. & Roever, W. E.: 5246 (15)
Churchill, S. & Betancur, J.: 17031 (15)
Cid, C. A. *et al.*: 590, 965 (15)
Cilinski, J. & Cervi, A. C.: 118a (1)
Clarke, H. D.: 3685, 4898 (15)
Clarke, H. D. *et al.*: 5348 (15); 5571, 5600, 5726, 6881, 7260, 7397, 8232, 8377, 9197 (24)
Clement, F.: 1007 (16)
Clute, W. N.: 78 (25)
Coelho, R. L.: 1481 (15)
Cogollo, A. *et al.*: 3325 (24)
Condack, J. P. S.: 267 (1), 370 (7)
Connant, D. S. *et al.*: 977 (15)
Cook, O. F. & Griggs, R. F.: **80** (6)
Cordeiro, I. *et al.*: 1298 (1)
Cordeiro, J. & Manosso, A.: 285 (1); 289 (7)
Cordeiro, J. & Ribas, O. S.: 1398 (1)
Cordeiro, J. & Silva, J. M.: 231 (21)
Cordeiro, J. *et al.*: 1725 (1); 2359 (21)
Core, E. L.: 1345, p.p. (3); 1345, p.p. (26)
Cowan, R. S.: 1378 (24)
Cowan, R. S. & Wurdack, J. J.: **31164** (18); 31211 (24); 31415 (12); 31483 (15)
Cremers, G.: 4486, 7006, 7260, 8281, 8687, 9910, 10771, 11632, 12172 (15)
Cremers, G. *et al.*: 9028 (24); 10177 (15); 10248 (24)
Croat, T. B.: 71244 (5)
Croat, T. B. & Hannon, D. P.: 64276 (24)

Cruz, J. M. & Ribas, O. S.: 121 (21)
Cruz, J. M. *et al.*: 272 (1)
Cuatrecasas, J.: 16880 (15); 17217, 21100 (24)
Damasceno, E. R. & Condack, J. P. S. 343 (7)
Damasceno, E. R. *et al.* 420 (1)
Damazio, L.: 185 (7); 1247 (1); 1656 (7); s.n. (7)
Daniel, B.: 1727 (2)
Daniëls, A. G. H. & Jonker, F. P.: 959 (24)
d'Assumpção, G.: s.n. (7)
Davidse, G. & Herrera, G.: 29398 (13)
Davidse, G. & Holland, D. L.: 36701, 36782 (24)
Davidse, G. & Huber, O.: 22882 (24)
Davidse, G. & Miller, J. S.: 27056, 27071, 27214 (15)
Davidse, G. *et al.*: 25822 (13)
Dávila, E. N. *et al.*: 28 (24)
Davis, P. H. & Coelho, D. F.: 60332 (15)
Day, E. H.: 4691 (16); s.n. (8)
Day, J.: 233 (14)
Delgado, L.: 405 (15)
Díaz, C. & Peña, A.: 8810 (9)
Diaz, W. *et al.*: 4747 (15)
Dittrich, V. A. O.: 1127 (1)
Dittrich, V. A. O. & Amado, E. F.: 388 (7); 396 (1)
Dittrich, V. A. O. & Jorge, M. C. O.: 421 (7)
Dittrich, V. A. O. *et al.*: 217 (1)
Döbbeler, P.: P61 (24); 189B, 579 (9)
Dombrowski, L. D.: 13304 (1)
Dombrowski, L. D. & Scherer, G. C.: 12139 (1)
D'Orbigny, A.: 295 (4)
Douglas: s.n. (3)
Dudley, T. R.: 11134A (13)
Duke, J. A.: 11675 (15); 13219 (6)
Duss, P.: 5 (3); 277, p.p. (20); 757, 1554 (24); 1654, p.p. (20); 1654, p.p. (24); 1654b, p.p. (20); 1654c, p.p. (24); 1655, p.p. (8); 4048 (24); 4084, p.p. (11); 4084, p.p. (20); 4084, p.p. (24); 4085, p.p. (20); 4085, p.p. (24), 4086, p.p. (20); 4086, p.p. (24); 4087 (8); 4145, p.p. (24); 4371, p.p. (20); 4371, p.p. (24)
Dutra, J.: 196 (1)
Eggers, H. F. A.: 3685 (16); 7128, p.p. (3)
Egler, W.: 97 (1)
Eiten, G. & Eiten, L. T.: 7742-A (7)
Ekman, E. L.: 2982a, 4768, p.p. (24); 4768, p.p. (25); 5209a (22); 12732 (16); 16311 (24)
Endres, A. R.: s.n., p.p. (6); s.n., p.p. (24)
Engelmann, R.: 62, 251 (21); 278, 290 (1); 298 (7)
Engler, A.: 134 (26)
Evans, A. M.: 2609 (25)
Falkenberg, D. B.: 6229 (1)
Fay, A.: 1502 (26)
Fay, A. & Fay, L.: 2598 (13); 2602, 2954 (2); 3686 (24); 3733, 3765 (6)
Feldmann, J.: s.n., p.p. (20); s.n., p.p. (24)
Fendler, A.: 211, p.p. (23); 211, p.p. (26); s.n. (26)
Fernández, A.: 5355, 5435 (24); 5602, p.p. (15)
Fernández, A. & Aymard, G.: 4849 (24)
Fernández, A. & Yanez, E. S-M: 6398 (15)
Fernández, A. *et al.*: 6077, p.p., 6068, p.p., 6083, p.p. (24)
Feuillet, C.: 9844 (15)

Finlay, K.: 24 (24)
Fisher, G. L.: 157 (16)
Flora Falcón: 139 (24)
Forero, E. *et al.*: 4053 (18)
Fortes, A.: 118 (1)
Förther, H. *et al.*: 10135a, 10462 (3)
Fosberg, F. R.: 19119 (26); 19940 (5)
Foster, R. B.: 8616 (24)
Frazão, A.: s.n. (1)
Friend, E. A.: 22 (24)
Fuentes, A.: 12127, p.p. (2)
Fuentes, A. *et al.*: 5072 (4); 11032 (26); 11854 (4)
Furlan, A.: 528 (1)
G. F. P.: s.n. (25)
Galeotti, H.: 6378 (25)
Garcia, E. *et al.*: 4468 (4)
Garcia, M. & Rodríguez, L.: 191 (15)
Gardner, G.: 107 (1)
Gaudichaud, C.: s.n. (21)
Gavilanes, M. & Funk, V.: 838 (2)
Gehrt, A.: s.n. (1)
Gentry, A. & Mori, S.: 13697 (24)
Gentry, A. *et al.*: 40785 (24); 48139 (26)
Gilbert, B. D.: 151-2 (8); 175, p.p. (25)
Glaziou, A.: 2416, **2460,** p.p., 4407, 5251 (1); 15753, s.n. (15)
Glaziou, A. & Schwacke, C. A. W.: s.n. (1)
Godman, F. D.: s.n. (3)
Gollmer, J.: s.n. (26)
Gómez, L. D.: 4072 (9); 19274 (5); 22531 (13)
Gomez, S.: 114 (25)
Goudot, M. J.: 16 (2)
Graham, J. G.: 5807 (5)
Grant, M. L.: 9702 (9); 9821 (26); 9879, p.p. (5); 9879, p.p. (26)
Granville, J. J. de: 3387, 3557, p.p. (15); 3557, p.p. (24)
Granville, J. J. de *et al.*: 6017, 8677, p.p. (15); 8677, p.p. (24); 12318, 15439 (15); 16809 (24)
Grayum, M. H. & Perry, D.: 10675 (24)
Grayum, M. H. & Quesada, F.: 7416 (9)
Guarim Neto, G. *et al.*: 454 (15)
H. H. Y.: 38 (25); 271 (8); s.n. (25)
Hahn, W. *et al.*: 4338 (24); 4721 (15)
Hallberg, B.: 1728 (24)
Handro, O.: 395 (21); 651, s.n. (1)
Hansen, O.: 13, p.p. (3); 14 (8); 62, p.p. (3)
Hardison, L. *et al.*: 92C (24)
Harris, W.: 5582, p.p. (8); 7131, p.p. (25); 7141, p.p. (3); 7141, p.p. (25); 7143 (8); 7475 (3); 3180 (16)
Hart, J. H.: 204 (20); 794, p.p. (3); 799 (8); s.n. (3)
Hatschbach, G.: 2135 (21); 2220, 7073, 8234 (1); 13441, 14146 (21); 14836, 15266, 16020 (1); 16223 (7); 17146, 17313 (1); 18244 (21); 22220, 25371 (1); 25384 (7); 26001, p.p. (21); 26317 (1); 37625 (15); 44998 (21)
Haufler, C. H. & Roos, M. C.: 6936, p.p. (28)
Haught, O.: 5233 (26); 5242, 5364 (24)
Hawkins, T.: 1526, 2027, 2111 (24)
Hawkins, T. & Mejía, D.: 663 (25)
Helsek, H.: 1655, p.p. (14); 1756, p.p. (14)
Henkel, T. W. *et al.*: 1628 (24)

Hennipman, E. *et al.*: 6766, p.p. (28); 6845, p.p. (24)
Herrera, G.: 126 (24); 3670 (13)
Herrera, G. & Chacón, A.: 2726 (5)
Herrera, G. & Martínez, I.: 8017 (24)
Herrera, G. & Pinho, J. A. G. B.: 9859 (15)
Hertel, H.: 36780 (18)
Hertel, R.: 326 (21); 1305 (1)
Hess, W. E.: 7023 (24)
Hill, S. R.: 27919, p.p. (11)
Hirai, R. Y. & Prado, J.: 616 (1)
Hirai, R. Y. & Schwartsburd, P. B.: 608 (1); 613 (7)
Hirai, R. Y. *et al.*: 526, 537, 564 (7); 574, 583, 586 (17); 594 (1); 598, 599 (21); 601 (1)
Hodge, W. H.: 53 (20), **54** (11); 58 (20); 6087, p.p. (4); 6087, p.p. (9)
Hodge, W. H. & Hodge, B. T.: 1431 (11); 2792, 3963 (20)
Hoehne, F. C. & Gehrt, A.: 3540 (1)
Hoehne, W.: 135 (1)
Hoffman, B. & Gopaul, D. 455 (15)
Hoffman, B. & Jacobs, H.: 1175C (15)
Hoffman, B. *et al.*: 1925 (15)
Holm-Nielsen, L. *et al.*: 2920 (24); 5479 (13)
Holst, B. K. & Liesner, R. L.: 2833 (24); 3456 (18)
Holst, B. K. *et al.*: 5248 (24)
Hombersley, A.: 153 (24)
Hoover, W. S.: 2027 (5)
Howard, R. A.: 12319 (25)
Howard, R. A. *et al.*: 15642 (24)
Huber, O.: 4353 (15)
G.: 50 (1)
im Thurn, E. F.: 175, 178 (5); 348 (26)
Imaguire, N.: 521, 582 (1)
Irwin, H. S. *et al.*: 47778 (15)
Jameson, W.: 34 (2); 39 (5); **79** (13); 81, 115, 350 (5); 369, 371 (2); **780** (26); s.n. (24)
Jaramillo, M. R. *et al.*: 3704 (13)
Jenman, G. S.: 10 (22); 12 (8); 13 (25); 14 (3); 46, p.p. (8); 67 (3); 133, p.p. (8); **s.n.**, p.p. (3); s.n. (5); s.n. (8); s.n. (15); **s.n.** (16); s.n. (25)
Jiménez, A. M.: 1227, p.p. (24)
Jiménez, I.: 172 (4); 1770 (13)
Jiménez, I. & Gallegos, S.: 708, 918, 1005 (4)
Jiménez, I. & Moguel, A.: 1531, 1637 (4)
Jiménez, I. & Quisbert, J.: 29 (4); 32 (2); 377 (4)
Jiménez, I. & Vidaurre, V. H.: 537 (4); 557 (2)
Jiménez, I. *et al.*: 485 (4); 2918 (13); 2965 (4)
Joly, A. B.: 744 (1)
Jump, J. A.: s.n. (24)
Jussieu, A. H. L. de: s.n (20)
K. K.: 74 (24)
Kaehler, M.: 64, 67 (1)
Kaehler, M. & Silva, S. M.: 27 (1)
Kalbreyer, W.: 1184 (24); 1472 (26); s.n. (26)
Karsten, H.: s.n., p.p. (26)
Kelloff, C. L. *et al.*: 951, 1043 (15)
Kersten, R. A.: 654, 692, 729, 1032 (1)
Kessler, M. & Kelschebach, M.: 106 (4)
Kessler, M. *et al.*: 6566, 6618 (4); 6684 (13); 7092 (4); 7143 (5); 7169 (4); 7173, p.p. (27); 7174, 7175 (4); 7177, 10234 (26); 11892, 11973, 12195 (4); 13275 (26)

Killip, E. P.: 316 (25); 34287 (15); 35212 (24); 37346 (15)
Killip, E. P. & Cuatrecasas, J.: 38919 (24)
Killip, E. P. & Garcia, H.: 33657 (24); **33887** (10)
Killip, E. P. & Rohl, E.: 37170 (23)
Killip, E. P. & Smith, A. C.: 24548 (18)
Kirkbride Jr., J. H. & Duke, J. A.: 1380 (15)
Kirkbride Jr., J. H. & Lleras, E.: 2812 (15)
Kluge, J.: 2087 (9); 1310 (24); 2231 (26); 3567 (24); 5624 (5); 5644 (28); 5932 (26); 6235 (9); 6458 (28); 7203 (24); s.n. (14); s.n. (24)
Koczicki, C.: 55 (21)
Koptur, S.: 219 (24); 241 (5)
Krömer, T. & Acebey, A.: 1367 (4); 2541 (25)
Kuehn, E. & Kuhlmann, M.: 2136 (1)
Kuhlmann, J. G.: 46 (1); 1611 (15)
Kukle, P.: 198 (15)
Kummrow, R. *et al.*: 3177 (1)
Kuniyoshi, Y. S.: 5918 (1)
Kupper, W.: 333 (24); 647 (3); 766 (24)
L'Herminier, F.: 15 (11); 106, p.p., 129, p.p. (20); 134 (24); 145, p.p. (25); s.n., p.p. (11); s.n. (14); s.n. (20); s.n. (24)
Labiak, P. H.: 486 (7); 490, 491; 657 (1); 670, 692, 696, 719, 874, 885 (7); 970 (1); 989 (21); 996, 1098 (1)
Labiak, P. H. & Kaehler, M.: 2055 (7)
Labiak, P. H. *et al.*: 1246 (7); 1249 (1); 3407 (7); 3612, 3627 (1); 3631 (7); 3642 (1); 3870 (7); 3920 (1); 3922, 4076, 4099 (7); 4723 (4)
Lagasa, E.: 49 (7)
Lanjouw, J. & Lindeman, J. C.: 2592 (15)
Lankester, C. H.: s.n. (26)
Lanstyack, L.: s.n. (1)
Lechler, W.: **2567** (13); s.n. (4)
Lehmann, F. C.: **1951** (24); **3257** (5); 7653 (26); 7655 (10); s.n. (26)
Lehnert, M.: 182 (5); 387, 486 (4); 597 (2); 862, 918a (26); 929 (18); 935, p.p. (2); 935, p.p., 976 (26); 977 (9); 1419 (26); 1420, p.p. (3); 1426 (9)
Lellinger, D. B. & Sota, E. R. de la: 19, 153 (15); 264, 313 (24); 595 (15); 783 (24)
Lellinger, D. B. & White, J. J.: 1331 (24)
Leon, Fre.: 11115 (22)
Leon, Fre. *et al.*: 10503 (16)
Leoni, L. S.: 73 (7)
Leprieur, F. M. R.: s.n. (15); s.n., p.p. (15); s.n., p.p. (24); **s.n. [140]** (15)
Levy, P.: 1491 (24)
Liesner, R. L.: 17674 (18) **18241** (12) **23289** (19) 24778 (26) 24841 (5)
Liesner, R. L. & Carnevali, G.: 22509 (24); 22662 (18)
Liesner, R. L. & Delascio, F.: 21999 (18)
Liesner, R. L. & González, A.: 9904 (26); 10276 (15)
Liesner, R. L. & Holst, B. K.: 21291 (15); 21647, p.p. (26); 20825 (24); 21670 (26)
Liesner, R. L. & Morillo, G.: 13928 (15)
Liesner, R. L. *et al.*: 25183 (26)
Lima, A. S.: s.n. (1); s.n. (7)
Lima, C. P. & Zimmermann, L.: 85, 86, 95, 97 (1)
Lindeman, J. C.: 3516, 4030 (15)
Lindeman, J. C. & Haas, J. H.: 5223 (1)
Linden, J.: 171 (26)
Liogier, A. H.: 9587, 10093, 10743 (24); 11355, 11963, 13370 (25)
Liogier, A. H. & Liogier, P.: 26611 (25)
Little Jr., E. L.: 9349 (4); 9354a (9); 9354 (26)

Llyod, F. E.: 121, 874, 897 (20)
Lockhart, D.: 142 (15); 143 (24); 375 (15)
Lombardi, J. A.: 128 (1)
Lopes, M. S.: 254 (15)
Lopes, M. S. & Pietrobom, M. R. S.: 243, 518 (15)
Loureiro, A. *et al.*: s.n. (15)
Luederwaldt, H.: 22002 (1); s.n. (1)
Luetzelburg, P.: 7376 (21); 12947 (1); 20298 (15); s.n. (21)
Luis: 32 (15)
Luteyn, J. L. & Escobar, O.: 13268 (24)
Luteyn, J. L. *et al.*: 10786B (24)
Lutz, A.: 312 (21)
Lutz, B.: 1812, 1970 (21); 2035, 2089 (1)
Maas, P. J. M. & Martinelli, G.: 3369 (21)
Maas, P. J. M. *et al.*: 5827 (15); 7482 (24)
Madriñán, S. & Barbosa, C. E.: 328 (24)
Magalhães, H.: 101 (1)
Mägdefrau, K.: **464** (23)
Maguire, B.: 24567, 24633 (24); 24771 (15); 32861 (24); 33476 (5)
Maguire, B. & Fanshawe, D. B.: 23253, p.p. (15); 23253, p.p. (24)
Maguire, B. & Politi, L.: 27743, p.p. (18); 27743, p.p. (24); 27990 (18)
Maguire, B. *et al.*: 39115 (15); 46832, p.p. (24); 56514 (15); 60536, p.p. (5); 60536, p.p., 65651 (26)
Malme, G. A.: 1696 (15)
Marie, E. A.: s.n., p.p. (2); s.n. (24)
Matos, F. B. & Silva, M. O.: 173 (21); 176 (1)
Matos, F. B. *et al.*: 77 (7); 927 (7)
Mattos, A.: s.n. (1)
Mattos, J.: 13535 (1)
Mattos, J. & Mattos, N.: 15102 (1)
Maxon, W. R.: 392 (26); **406** (24); 456 (26); 486 (24); 1101, 1475 (3); 2687, 2725, 2745, 2752 (25); 2753 (3); 9580, 9634, 9679 (25); 9761, p.p. (8); 9763 (25); 9765 (3); 9793 (8); 9858 (3); 9869 (8); 9885 (3); 9955 (3); 9961 (8); 9999 (3); 10107, 10220, 10239 (25)
Maxon, W. R. & Killip, E. P.: 1159, 1187 (25)
Mazé, H. P.: **18** p.p. (24); 182, p.p. (20); 673, p.p. (24); 674, p.p., 700, p.p. (20); s.n. (24)
McDowell, T. *et al.*: 4689 (24)
Mees, G. F.: s.n. (24)
Meier, W.: 3272 (24); 3506 (26)
Meier, W. & Elsner, D.: 6680 (24); 6689 (24)
Meier, W. & Kunert, O.: 4569, p.p. (24); 4569, p.p. (26)
Meier, W. & Mentel, C.: 11892 (24)
Meier, W. & Molina, P.: 6814, 9205 (24)
Meier, W. & Reif, A.: 635 (26)
Meier, W. & Struppek, R.: 10730, 10732, 13478 (24)
Meier, W. *et al.*: 1442, 3913, 6730, 10319, 10334, 11139, 11994 (24)
Mello, L. E. & Emmerich, M.: 3907 (1)
Melo, L. C. N.: 35 (7)
Mendonça, R.: 408, 1147 (1)
Mexia, Y.: 4052 (7); 4056 (1); **6930** (6); **8147a** (4)
Mgf. [Markgraf, F.] & App.: 10452 (1)
Mickel, J. T.: 2022, 2559, 2587 (24); 2666 (3); 2929, p.p. (6); 2929, p.p. (24); 3030, p.p. (5); 3030, p.p. (28); 3076, 3396, 3607, p.p., 3641, 9506, 9587 (24); s.n. (24)
Mickel, J. T. & Hellwig, R. L.: **3824** (3)
Mickel, J. T. *et al.*: 8339 (3); 9050 (16)
Miers, J.: 38 (1)
Mocochinski, A. Y. & Scheer, M. B.: 353 (1)

Molina, A. R.: 20538 (24)
Molina, A. R. *et al.*: 17479 (24)
Monsalve, B. M.: 2112 (24)
Monteagudo, A. *et al.*: 4737 (4); 4794 (13)
Moore, A.: s.n. (3)
Moore Jr., H. E. *et al.*: 9673 (15)
Moran, R. C.: 5065 (24); 5580 (3)
Moran, R. C. & Moran, C. K. R.: 5819 (24)
Moran, R. C. & Rohrbach, C.: 5104, 5270 (5)
Moran, R. C. *et al.*: 6870 (2); 7447 (5); 7512 (24)
Mori, S. & Assunção, P. A. C. L.: 21385 (15)
Mori, S. *et al.*: 22264 (15)
Morillo, G.: 2604 (24)
Moritz, J. W. K.: 252, p.p. (3); 252, p.p. (225); **252,** p.p. (26); 311, p.p. (3); 333, p.p. (23); **333,** p.p. (26); s.n. (23); s.n., p.p. (23); s.n. (26)
Morton, C. V. & Acuna, J.: 3552 (25)
Mostacero, J. & Castillo, R.: 395 (26)
Mostacero, J. *et al.*: 356, 448 (26)
Motta, J. T.: 526 (21)
Moura, T.: 32 (1)
Müller, J. & Heinrichs, J.: 6173 (4)
Mynssen, C. M. *et al.*: 993 (1)
Napp-Zinn, A.: 17 (24)
Nee, M.: 42641, 42839 (15)
Neill, D. *et al.*: 11886 (13); 14481 (18)
Nelera, C. W.: 4745 (15)
Nelson, B. W.: 327, 346 (15)
Nelson, C. & Andino, R.: 14422, 14456, 15564 (24)
Nelson, C. & Clewell, A.: 443 (24)
Nelson, C. *et al.*: 10961 (24)
Nicolau, S. A. *et al.*: 1658 (1)
Ohba, T. & Barbosa, C.: 140 (18)
Øllgaard, B.: 98530 (13)
Øllgaard, B. & Balslev, H.: 9222 (24)
Øllgaard, B. *et al.*: 57291 (24)
Orcutt, C. R.: 2886, p.p. (25); 5317, 5318a (3)
Ortega, F. & González, A.: 399 (24)
Ortega, F. *et al.*: 2774, p.p. (24); 2774, p.p. (26)
Otero, J. I.: 29 (24)
Pabst, G. & Pereira, E.: 5864 (1)
Palacios, P. *et al.*: 2460, p.p., 2579 (15)
Palacios, W. & van der Werff, H.: 3755 (9)
Pearce, R.: s.n. (4)
Pennell, F. W.: 4355 (5)
Pereira, E.: 1936 (21)
Perrottet, G. S.: **s.n.,** p.p. (20), s.n. (20)
Petean, M. P.: 100, 131 (1); 154 (7)
Pételot, P. A.: s.n. (15)
Pipoly, J. J. *et al.*: 10994, p.p. (24)
Pittier, H.: 709 (14); **1928** (9); 9997, 10070 (26); 10973, 10976, 11821 (24)
Plowman, T. *et al.*: 12322 (15)
Porto, P. C.: 3086 (1)
Prado, J. & Labiak, P. H.: 1657 (1); 1670 (21)
Prado, J. & Marcelli, M. P.: 795 (1)
Prado, J. *et al.*: 344-A, p.p. (21); 590, 640 (15)

Prance, G. T. *et al.*: 3108, 11326, 14813, 17943, 19083, 19141 (15); 29130, p.p. (24)
Proctor, G. R.: 3704 (25); 4343, 4352 (3); 4586 (24); 5787 (25); 39519 (24)
Puiggari, J.: s.n. (1)
Purdie, W.: **s.n.,** p.p. (8); s.n. (25); s.n., p.p. (3); s.n., p.p. (25)
Queirós, C. M.: 1234 (24)
Quelch, J.J. & McConnell, F.: 49 (3)
Quijada, C.: 4 (23)
Raddi, G.: 119 (21)
Ramírez, B. R. P.: 4726 (2)
Ramos, J. E. *et al.*: 1309 (26)
Reitz, R.: C396 (21); C2097 (1)
Reitz, R. & Klein, R.: 6421 (21)
Ribas, O. S. & Cordeiro, J.: 728 (1)
Ribas, O. S. & Silva, J. M.: 3283A (21)
Ribas, O. S. *et al.*: 3081 (7); 3565 (1); 6575 (21); 6577 (1); 6695 (21); 7204 (7); 7207 (1)
Ribeiro, J. E. L. S. *et al.*: 994, 972, 1266 (15)
Richard, L. C.: s.n. (15); s.n., p.p. (20); s.n., p.p. (24)
Richards, P. W.: 81, 100, 632 (15)
Riedel, L.: s.n. (15)
Rivero, R.: 2232 (24)
Rivero, R. & Diaz, W.: 2401 (24)
Rodrigues, A. J.: s.n. (1)
Rodríguez, L.: 4788, p.p. (24)
Rodríguez, L. & Hokche, O.: 1325 (15)
Rodrigues, W. & Coelho, L.: 1481 (15)
Rodrigues, W. & Loureiro, A.: 7092 (15)
Rodríguez, W. D. *et al.*: 4003, 4076, 4148 (24); 4500 (15); 4682 (5); 4685, 4723 (2); 4728, 4955 (5); 4968 (26); 5496 (9); 5648 (3)
Roig, J. T.: 7151 (25)
Rojas, A.: 3209 (13); 3210, 3528, p.p. (9); 3603 (14)
Rojas, A. & Mata, M.: 3007 (24); 3021 (28)
Rojas, A. & Soto, A.: 4258 (28)
Rojas, A. *et al.*: 4195 (24)
Rolim, L. B. & Silva, J. L.: 193 (1)
Rolim, L. B. *et al.*: 297 (1); 323 (7)
Rosário, C. S. *et al.*: 443 (15)
Rothfels, C. J. *et al.*: 08-116 (24)
Rowlee, W. W. & Rowlee, H. E.: 234 (24)
Salino, A.: 389 (15); 567 (1); 2927, 3820, 4367, 4859, 4947 (7); 5756 (17); 5760 (7); 6459 (1); 6523 (7); 6556, 6616 (21); 6934 (7)
Salino, A. & Almeida, T. E.: 10489 (7)
Salino, A. & Carvalho, F. A.: 7638 (7)
Salino, A. & Morais, P. O.: 4546 (1)
Salino, A. & Mota, N. F. O.: 8239, 8907 (17)
Salino, A. *et al.*: 5297 (7); 5389 (1); 5513 (7); 5514 (1); 6159 (21); 6162, 6310, 6353 (1); 6355, 7295 (7); 7298 (1); 7430 (7), 7432 (21); 7520, 7575, 7734 (7); 7766 (21); 7785, 7809 (7); 7841 (1); 8520 (7); 8673 (1); 8718 (17); 8824, 9242 (7), 9743 (1); 9974, 11096 (7); 11268, 11965 (1); 12832 (7)
Salvador, G. S.: 40 (1)
Sampaio, A. J.: 2057, 2070, 2236 (1)
Sánchez, C. & Liogier, A.: 129, 130, 146, 226, 236, 238 (24)
Sánchez, D. *et al.*: 562 (24)
Sandwith, N. Y.: 1198 (15)
Sanoja, E. *et al.*: 2960 (24)
Santos, J. U. & Rosário, C. S.: 365 (15)

Santos Lima, J.: 221 (1)
Santos Lima, J. & Brade, A. C.: 13169, 14363 (7)
Scaramuzza Filho, M.: s.n. (1)
Scheer, M. B. & Proença, R. T.: 734 (1)
Schenck, H.: 2726 (1)
Schmalz, A.: 106 (1); 112 (7)
Schmalz, L.: s.n. (7)
Schmalz, R.: s.n. [Rosent. 146] (1)
Schomburgk, R. H.: 3 (25); 1171, p.p. (5); 1171, p.p. (26); 1173 (5); s.n. (26)
Schunke, C.: A157
Schwacke, C. A. W.: 187, 844 (15); 1482 (24); **9488**, 12549, 13612, 14209, 14246, 14362 (7)
Schwartsburd, P. B. & Lima, A. M. X.: 1295, p.p. (7)
Schwartsburd, P. B. & Peres, C. K.: 899 (7); 900 (1)
Schwartsburd, P. B. *et al.*: 1791 (17)
Seemann, B. C.: 231 (24)
Segadas-Vianna, F.: 2838 (1)
Sehnem, A.: 6276 (1)
Seiler, R.: 1135 (3)
Sellow, F.: s.n. (1)
Shafer, J. A.: 291, 2250, 3233, 3316 (24)
Sherring, R. V.: **156** (24); **s.n.** (22)
Shirata, M. T.: 3425 (1)
Sick, H.: s.n. (15)
Silva, J. M. *et al.*: 4080 (1)
Silva, J. S. *et al.*: 4076 (1)
Silva, M. *et al.*: 1971 (15)
Silva, N. T.: 2070 (15)
Silverstone-Sopkin, P. A. *et al.*: 2791A (5); 2791, 3605, 3903 (26); 4375A (5); 4375, 4915, 6646 (26)
Simonis, J. E. & Martinelli, G.: 31-A (21)
Sintenis, P.: **1796,** p.p. (24); **4327b, p.p.** (24); **5462b, p.p.** (24)
Skutch, A. F.: 2393, 2826 (15); 2872 (24); 5228, 5244 (15)
Smith, A.: 1455 (24)
Smith, A. C.: 2672, 3016 (15)
Smith, A. R.: 2081, 2583 (9); 2584 (14)
Smith, A. R. & Béliz, T.: 2112 (9)
Smith, A. R. *et al.*: 1100 (24); 1102, p.p., 1113, p.p. (26); 1278, p.p. (24); 1280 (26); 1335 (24); 1446 (26); 1649 (24); 1737 (26); 2156 (5); 2157 (26); 2200 (18); 2217, 2417 (24); 2426 (14); 2428 (5); 2827 (24)
Smith, D. N.: 3805 (15)
Smith, D. N. *et al.*: 7853 (4)
Smith, H.: 46 (15); s.n. [Schwacke 5001] (15)
Smith, L. B. & Klein, R.: 8542 (1)
Smith, U. C.: s.n., p.p. (16)
Sobral, M. & Oliveira, A. G.: 10657 (15)
Solomon, J. C.: 9665 (4)
Sota, E. R. de la: 5216, p.p. (18); 5216, p.p. (24); s.n. (15)
Souza, F. S. *et al.*: 52 (1)
Souza, V. C. *et al.*: 23621 (1)
Souza, W. S.: 1063 (21)
Spannagel, C.: s.n. (1)
Sperling, C. R. & Bleiweiss, R.: 5085 (24)
Spruce, R.: 4745, p.p. (15); 4745, p.p. (24); 4750, **4780** (26); 5273, p.p. (5); 5273, p.p. (24); 5282 (26)
Standley, P. C.: 91702 (24)
Standley, P. C. & Valerio, J.: **50495** (28)
Stehlé, H.: 1208, 1768, 2413 (20); 2422 (24)

Stehlé, H. & Stehlé, M.: 656, p.p., 1467a, 1467b, 1468a, p.p., 1469, p.p. (20); 1470, p.p. (24); 1474, 1763, 1767, 1769, 1771, 1772, 1773, 1781 (20); 1784, p.p. (24); 1885 (20)
Stehmann, J. R. *et al.*: s.n. (7)
Stein, B. A. & Gentry, A.: 1607A (26)
Stergios, B.: 2256 (26); 12079 (15)
Stergios, B. & Delgado, L.: 12429 (15)
Stevens, G. L. & Hess, W. E.: 2804 (24)
Stevens, H. I. *et al.*: 189 (24)
Stevens, W. D. & Krukoff, B. A.: 11523, p.p. (24)
Steyermark, J. A.: 53464 (2); 58888, 59582, 74948, p.p. (5); 75704 (20); 89102, 89144, 89616 (24); 90175, 90320 (15); 93292 (18); 93416 (24); 93416B, p.p. (18); 93416B, p.p. (24); 94813 (24); 98095 (26); 107224, 129617 (18)
Steyermark, J. A. & Agostini, G.: 91065 (24)
Steyermark, J. A. & Bunting, G.: 103083 (15)
Steyermark, J. A. & Delascio, F.: 129279 (5)
Steyermark, J. A. & Liesner, R. L.: 120846, p.p. (24)
Steyermark, J. A. & Nilsson, S.: 54 (24)
Steyermark, J. A. & Wurdack, J. J.: 1148 (26)
Steyermark, J. A. *et al.*: 98720 (3); 109107 (24); 115650 (19); 120024, 121633 (24); 123952 (18); 124858 (24); 126043 (5); 131054 (24)
Stolze, R. G.: 1631 (24)
Stork, H. E.: 440 (24); 2336 (3); 2350 (9); 2700 (24); 3105 (15)
Strudwick, J. J. *et al.*: 3524 (15)
Stubblebine, W. H. *et al.*: 13218 (21)
Stübel, M. A.: 188 (2); **747** (24)
Sucre, D. *et al.*: 4860 (15)
Sugden, A.: 26 (24)
Sundue, M.: 1127 (9); 1146 (26); 1148 (9); 1352, 1653 (24)
Sundue, M. & Farrar, D.: 1344 (9)
Sundue, M. & Vasco, A.: 1226 (26); 1240 (3); 1305, 1311 (9)
Sundue, M. *et al.*: 1729 (26); 1734, 1744, 1758 (24); 1764, 1771 (6)
Swartz, O. P.: **s.n.** (25); **s.n.**, p.p. (14); s.n., p.p. (25)
Sylvestre, L. S. & Condack, J. P. S.: 1736 (1)
Sylvestre, L. S. *et al.*: 382 (1); 1875 (7)
Tate, G. H. H.: 346 (13); 1055 (24); 1252 (18)
Tavares, A. S. *et al.*: 84A, 85 (18)
Taylor, N.: 540 (16)
Thiébaut, C.: s.n., p.p. (24)
Thomas, W. W. & Plowman, T.: 3091, p.p. (5); 3091, p.p. (26)
Thomas, W. W. *et al.*: 4510 (15)
Thorp, J.: s.n. (24)
Tillett, S. S. *et al.*: 43963A (24)
Toledo Jr., F. T. de: 483 (7); s.n. (7)
Tonduz, A.: 17607 (24)
Tosta Silva, A.: 24, 458, 498 (1)
Triano-Moreno, L. A.: s.n. (24)
Ule, E.: 13, 5327 (15); 8519 (5); s.n. (1); **s.n.** (17)
Underwood, L. M.: 515, 600, 615, 807, 949, 954, 958 (25); 961, p.p. (3); 961, p.p., 966, 970, 978, 979, 989, 997, 1013, 1082, 1085 (25); 1452, 1455, 1462, 1464, 1468 (3); 1472 (8); 1477 (3); 2107, 2108, p.p. (14); 2108, p.p. (25); 2388, 2406, 2455, 2488, p.p. (25); 2493, 2577, 2581, 2584 (3); 3165 (25); 3174 (8); 3175 (25); 3178, 3188 (3); 3191 (8); 3196, p.p., 3198 (25); 3201 (3); s.n. (3); s.n. (8); s.n. (16)
Usteri, A.: 21934 (7); s.n. (7)
Valdespino, I. A. *et al.*: 575 (24)
van der Werff, H.: 3492 (24)

van der Werff, H. & González, A.: 5005 (15)
van der Werff, H. & Gudiño, E.: 11456 (13)
van der Werff, H. & Herrera, J.: 6462 (5); 7295 (14)
van der Werff, H. & van Hardeveld, C.: 6589, 6719 (24)
van der Werff, H. *et al.*: 8490 (4); 8800 (13); 9511, 11888A, 11924 (24); 13103 (18); 13445 (5); 16670 (26); 16713 (5); 16731 (26); 18539, p.p. (4); 18539, p.p., 18573 (5); 18575 (4); 19433 (18); 19451 (26); 21206 (4)
Vareschi, V. & Foldats, E.: 4652 (18); 4929 (5)
Vareschi, V. & Pannier, F.: 1185 (26)
Vargas, H. & Naváez, E.: 3128, 3423, 3501 (5)
Vargas, J. M.: 695 (3)
Vasco, A.: 241 (15)
Vasco, A. & Sundue, M.: 618 (24); 626 (26)
Vasco, A. *et al.*: 494, 495 (24); 530 (9); 823 (3)
Vasconcelos, M. F.: s.n. (1)
Vasquez, R. & Francis, R.: 28042 (4)
Vasquez, R. *et al.*: 28125 (5); 28452(13); 28455 (5); 28798 (4)
Vervloet, R. R. *et al.*: 1930 (7)
Vicentini, A. & Pereira, E. da C.: 918 (15)
Vieira Filho, J.: 15 (1)
Vital, D. M.: s.n. (1); s.n. (15)
von Goebel, K. I. E.: s.n. (26)
von Humboldt, F. W. H. A.: 444 (24)
von Türckheim, H.: 2383 (25)
Wacket, M.: 700 (1); s.n. (1)
Wagner, W. H.: s.n. (24)
Warrington, J. F. *et al.*: K.E.R. 9 (24)
Warszewicz: 61 (26)
Watkins, C.: s.n. (24)
Watt, M. D.: 182 (16); 183 (25)
Weber, H.: 887 (15)
Webster, G. L. *et al.*: 8651 (24)
Wells-Windisch, R. & Ghillány, A.: 287, 405 (1)
Wercklé, C. 273 (26); s.n., p.p. (14); s.n. (24); s.n. (26)
Werner, F. A.: 857 (3)
Wiggins, I. L.: 10402, 10412 (2); s.n. (13)
Wilbur, R. L. *et al.*: 8084 (20)
Williams, L. O. & Molina, R. A.: 20007 (24)
Williams, L. O. *et al.*: 27621 (24); 41935 (25)
Williams, R. S.: 452 (15); 891, 892 (24); **1167** (27)
Wilson, K. A. & Webster, G. L.: 608 (25)
Wilson, P.: 179 (24)
Windisch, P. G.: 1285, 1575 (15)
Windisch, P. G. *et al.*: 7722 (15)
Winter, S. L. de S.: 242 (7)
Wood, J. R. I.: 11577 (4)
Woodbury, R. O.: s.n. (24)
Wright, C.: 15 (5); 811, p.p., 1049, p.p. (16); s.n. (5)
Wurdack, J. J.: 1511 (9); 34093 (5)
Yuncker, T. G.: 18597 (25)
Yuncker, T. G. *et al.*: 6659 (25)
Zanoni, T. *et al.*: 45973 (25)
Zarucchi, J. L. *et al.*: 5661 (24)
Zuquim, G. & Silva, O. F.: 40 (15)

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